

AVIATION WEEK

A MCGRAW-HILL PUBLICATION

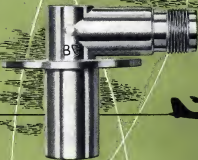
MAR. 17, 1952

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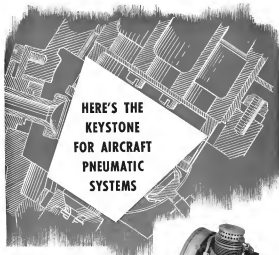
Designed for rugged dependability, for speed, stamina, versatility, the "Flying Boxcar" is a tribute to the engineering skill that planned and built it, and the men who fly it.

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Find out how leading aircraft companies are using this Kidde compressor as the heart of air-borne pneumatic systems. Write to today.

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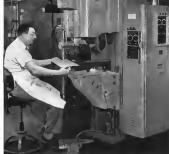
Are you faced with resistance welding high-temperature, high-strength alloys or aluminum for defense production? Trying to decide between three-phase and single-phase welding control? Write for G-E literature that describes both types. We know, from experience in our own as well as customers' plants, that both are being used. Which you select will depend to a great extent on these factors:

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Single-phase	Three-phase
1. Low initial cost	1. Low IORA demand
2. Low maintenance (except for	2. Reduced 3-phase line load
3. Simple to operate (line of	3. High power factor
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5. Voltage and current regulators can be added later if necessary	

General Electric has supplied, and used, both types to meet Army Navy specifications, and our nearest local office can give you information based on experience with this equipment and with welding high-strength alloys. Before you buy—investigate. Contact the nearest G-E sales office or write for Bulletin QED 1512 to Section AG45 55, General Electric Co., Schenectady, N.Y.

Ask your resistance welding manufacturer, power supplier, or nearest General Electric office for a FREE brochure of the award and other merits. "This Is Resistance Welding" describes various welding methods and processes. For production and engineering personnel: welding and resistance sources.



H. C. Wells, of the General Electric Electronics Laboratory Welding Section, says, "Tests in our Laboratory and in other General Electric Welding Laboratories show that single-phase ac welding using Slope Control are as good as three phase welding on aluminum. So far Class A spot welding of aluminum, the use of our c machine with Slope Control resulted in Military Specification MIL-W-6856 for 125-1257 325." His discussion has resulted in a considerable saving of money and time."



Three-phase at Ryan Aeronautical Company is San Diego controls several of the largest resistance welding machines in the country. Web G-E 3 phase control cover best settings can be obtained and duplicated later without variation. Uniform current is fed to the electrodes to produce the required heat with less unnecessary heat loss. Unbalanced spot welding is also eliminated—unproductive when welding sheets of different thicknesses.

GENERAL ELECTRIC



NEWS DIGEST

DOMESTIC

2,000th F-4 Thunderbolt has been delivered to USAF's 36 Republic of Korea Corp. This is the pre-test workup produced in the context of a single type of jet aircraft, although finished with its serial of 1,700 F-4B, plus out pair of F-35 and TV-2 (TD-2) trainers and F-4B, has made a large number of the Shooting Star in all its variants.

Edwin V. Hughes, Assistant Secretary of the Air Force, has been named as the Air Force member of the Air Commanding Committee. He replaces Russell L. Colgate on the committee.

Army Corps of Engineers has been forced into a \$7 million in equipment and facilities to Air Force at Whittier Municipal Airport, Kan. The facilities include 125 acres of heavy reinforced concrete runways, taxiways and VSI are parking ramp. Four miles of railroad lines, and standpipes are also included in the transfer. Army said, A total project expenditure of \$25 million has now been completed at that base. The airport is being used by the Air Force as a B-47 advanced flying school.

Dr. Theodore von Karmán, for the past seven years chairman of USAF's Scientific Advisory Board, has been named chairman of the research group North Atlantic Treaty Organization's Advisory Group for Aeronautical Research and Development (AGARD). The new group, composed of leading scientists from NATO, will have its headquarters in Paris.

Succession to the position of Secretary of Defense in the event of the death, disability or absence of the Secretary of Defense was set out last week in executive order of the President. The following officers, Thomas, ordered, would succeed, in the order named: Deputy Secretary of Defense; Secretary of the Air Force; Secretary of the Navy; Secretary of the Air Force.

L. B. Dorch, San Francisco Man of the Year, died Feb. 27 at San Mateo, Calif., after a heart attack. Holder of a commercial pilot's license, Dorch had been for many years an aviation counselor for Continental Air Lines, and because a member of the carrier's board of directors in 1946.

FINANCIAL

Glenn L. Martin Co. reports net loss for 1951 of over \$22 million on sales

of \$68.1 million. Earnings in 1950 came to a 1412 over \$42 million. Operating backlog at yearend stood at \$400 million. Stockholders will be asked to approve increase of common stock, to 1 million shares from 1.3 million, at Apr. 2 meeting.

Curtis-Wright Corp. reports \$6.9 million net income after taxes on sales of \$178 million in 1951. Last year's net was \$7.1 million. Income before taxes was nearly \$15 million, up from \$15.6 million last year. Total net profit sales, plus scheduled production under letter contracts, comes to \$1.025 million.

Hiller Helicopters 1951 net profit, less of \$1.5 million, on sales of \$5.7 million. Sales in 1950 were \$1.26 million in 1949 \$157,000. Company employment rose to 700 in 1951 from 550 in 1950.

Gannett Corp. has declared 40 cent dividend on its May 25 to stockholders of record Mar. 10.

Jack & Heilett, Inc. has declared regular quarterly dividend of 30 cents on its cumulative preferred stock, 475 shares (1950 par). Dividend is payable Apr. 5 to stockholders of record Mar. 20.

Electric Boat Co. has increased dividend 25 cent quarterly dividend to 50 cents. Consolidated backlog at Ebo and its subsidiary, Canine, Ltd., is about \$574 million. Stockholders are being asked to vote on reorganization of company into a Delaware corporation with the probable name of General Dynamics Corp.

Shick Aircraft reports 1951 gross revenues of nearly \$13 million, with net earnings of \$371,000 after tax and its various adjustments. Shick booked its 1950 net income of revenue flight to 49%, at \$7,569,617. Carrier has completed settlement of its 4% debentures for conversion to \$14 per value conversion, increasing outstanding conversion shares to 422,157.

Seller Aircraft Co. set for the year recently ended Jan. 31 was \$272,000, on sales of \$36 million, after settlement of \$3.5 million for taxes and refunds on government contracts. Figures for variable period last year were net, \$561,100; sales, \$16.1 million, for provisions, \$1.5 million. Backlog on Jan. 31 was \$87 million.

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Arrows point to machine close. One to release is not done by simply pulling the wing nut but by twisting to release pins.



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Mar. 17-19—Second Midwestern Conference on Fixed Machines, to be held at Ohio State University.

Mar. 17-21—American Society of Tool Engineers national exposition and annual meeting. Theme: "Looking for Security." Chicago. (For information, write Deakins & Co., 307 Bank Building, Detroit.)

Mar. 20—Institute of the Aeronautical Sciences 1st Los Angeles section dinner meeting. Speakers—Wichard Beck, Boeing Vertica Co., Los Angeles.

Mar. 20-21—Conference: Cooling of Airframe Structures Equipment, to be held at Ohio State University in conjunction with USAF Technical papers will be presented by 12 engineers and aircraft industries and research organizations. Ohio State University, Columbus.

Mar. 20-22—Aircraft Operations Council annual conference. (Hollywood Roosevelt Hotel, Hollywood, Calif.)

Mar. 20—Institute of Navigation officers regional meeting. U.S. Naval Academy, Annapolis, Md.

Mar. 24-26—American Society of Mechanical Engineers spring meeting, University of Washington, Seattle.

Mar. 18-Apr. 1—Convention of American Association of Airport Executives. Ft. Worth.

Mar. 31—Ballistics Scientific Council of N. I. annual conference, guests on metal warfare and quality control. Fort Belvoir, Nevada, N. I.

Apr. 1-4—22nd annual General New York Safety Conference. A. American Aircraft Safety and New York, New York.

Apr. 1-5—Conference on safety guidelines of various air transportation with 72nd annual Safety Conference of Georgia. New York. (Safety Council, Col. Gilbert F. York, USAF, will provide Hotel Statler, New York.)

Apr. 15-16—International Federation of Airway Pilots. Young annual convention, Nelson, Australia.

Apr. 18-24—National Aeronautics Meeting and Aircraft Engineering Exhibit. Society of Automotive Engineers, Hotel Statler, New York.

Apr. 25—Institute of the Aeronautical Sciences meeting. Cleveland, Ohio.

Apr. 26—International Air Transport Association. Convention special committee meeting. Bermuda.

May 1-4—4th annual Women Aeronautics Conference. Green Bay.

May 11—International Air Transport Association. (Aircraft meeting, Boston Area.)

May 13-14—National conference on airborne electronics, co-sponsored by Institute of Radio Engineers. Dayton, Ohio.

May 13-14—National conference on Airframe Flow. Dayton, Ohio. (Boeing, United States, Ohio.)

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FIRST OF THREE FOR ALGERIE—Now in service between Toulouse, France and Algiers, the Douglas DC-7B shown here is the first of a fleet for Air Algiers. The carrier expects to take delivery of two more of the low-engine, double-deck transports before this summer.



FERTILIZING FREIGHTER—Douglas DC-7B freighter ordered by the Royal New Zealand Air Force takes off from Winton, England, on its delivery flight. Plane is fitted with three 2-oz fertilizer hoppers for aerial top-dressing of hill pastures.



STANDARD FIFER—This popular sporter (shown) is the backbone of Donald Wagner, Portland, Ore. It's a Piper Cub, with just prop-draft standard for clearance with standard prop. Wing span is 31 ft., top speed is 122 mph. Price has topped up \$9,000 light base.

Plane News In Pictures

WHITE TOPS FOR TRANS WORLD—First photo (right) of Lockheed's assembly line for TWA's Super Constellation shows new production units. Second photo (left) shows the final assembly line, where the aircraft are mated to their engines, and the final check.





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WHO'S WHERE

In the Front Office

G. M. Moore, Associate Adjunct vice president, has been made responsible for direction and coordination of operations, maintenance, stocks and engineering departments. G. W. Janda, vice president, will handle the duties formerly performed by Moore including coordination of AN's Vietnam interest.

David F. Devine has been named vice president of the Army Corp., heading N. Y. electronics unit, and will head up the firm's financial division. Devine formerly was comptroller of Bell Aircraft Corp., Buffalo.

Vincent E. Fletcher has been designated assistant to the president and mutual operation secretary of Elctrol, Inc., Longport, N. Y. Fletcher is vice president of Elctrol of B. Smith, sales manager. Edward D. Holland manages development and engineering. George D. Lopez, plant manager and Randolph Rutenfranz, secretary.

Changes

Marvin V. Kallert, Jr. has been appointed manager of a large government project on development in Bendis Industries Corp. Kallert's experience includes a thorough guided missile background.

James G. Flynn, Jr., has been named director of the aviation and commercial sales division of Collins Radio Co., in addition to his post as assistant of Collins' Dallas test manufacturing division.

J. C. Totten has been designated chief engineer of power systems for AFSC division of General Motors. G. R. Holbrook has been made assistant chief engineer on production power systems and J. B. Whetzel is assistant chief engineer on development power turbine engines.

Paul E. Allen has been designated director of quality control for North Aircraft Corp.

Charles G. White, formerly assistant and public relations manager for Southern, Inc., has joined Panavia Helicopter Corp. as director of public relations.

Ted C. Fisher has been promoted to assistant sales manager of General Aircraft Service Corp. and Fred C. McFadden has been named assistant West Coast representative. Both will handle Hamilton Standard products.

Edward O. Rodgers has been appointed director of public affairs division of the Air Transport Unit.

What They're Doing

Edward J. Folan, formerly eastern region manager for Gordon D. Brown & Associates in Birmingham, D. C., has opened an office at 9414 Chancelor, Kensington, Md. to act as resident liaison representative and engineering and sales consultant to an unnamed client. The office, which is active since 1971, deals with civil aviation aircraft projects.

INDUSTRY OBSERVER

► Douglas Aircraft Co., notified by Air Force to test its old World War II Chicago plant (now occupied by Fairchild) for production of the Douglas twin-jet engine light fighter RB-66 is also planning to set up a dual production line for its piston-engine Navy attack plane, A-1H, and S. Navy version of the RB-66, designated A-1D, is just getting ground for first flight tests at Edwards AFB. Scheduled by Navy to be in full production by December, 1971, for use almost the new \$7,000,000 USS Forrestal, firm decision as to location of A-1D production has not been made, although the Chicago facility is probable site.

► Glenn E. Martin Co., licensed by English Electric Co., to build the B-7A Canberra for U.S. tactical Air Force wings, continues tests in difficult engineering problems in connection with altering Canberra design to meet the needs of U.S. mass production methods. Latest advance in that test flight of first U.S. prototype will be delayed until mid-1973, with production start beginning at year-end, 1973. The plane is currently scheduled to be powered by two Wright built, English licensed Supercub J61 jet engines.

► General Aircraft Co. plans to double production of its Model 170 by the end of 1972, as a result of mounting orders for the 1972 version with its new high-life flap and redesigned control system. Necessary increased material allocation in the production line has been approved in Washington, the company states.

► U.S. aircraft manufacturers are adding the MacArthur Award to set up an anniversary project to standardize the model specifications issued by the military aircraft to be given. Specifications are getting new copyright, with the Army, Marine and Coast Guard now getting into the act, along with Air Force and Navy, and the manufacturers would like to explore the chances there might be of developing a standard spec format.

► Canadian version of the North American F-86E weighs 36,500 lb., according to latest information. Powerplant is the General Electric J69GE-17 turbojet. While performance figures are classified in secrecy, its service ceiling is reported to be 51,000 ft. with a 57,000 ft. absolute ceiling. Tactical radius is reported as 515 mi.; cruising radius 1,750 mi., and service range 1,750 mi. The Royal Canadian Air Force has limited equipping one complete squadron with Canadian F-86E fighters and is due to receive two other squadrons. All three will have the No. 1 fighter wing which is scheduled to be based at North Toronto, England.

► General has removed a \$210,000 development contract from USAF to develop titanium alloy parts for jet pods. Although titanium has long been attractive in an aircraft material because of its high strength-to-weight ratio and its heat resistance and corrosion resistant properties, increased costs, refining processes are needed to make it as available as lower cost. Consequently, refined titanium will be 520¢ per pound on the commercial market, General reports.

► AE Wilbur Air Transport plans to begin to operate through tropical areas as scheduled for a new jet pod. Plans will be tested with a white solar-resistant lacquer on cabin and exterior. Tests have indicated that the lacquer can reduce cabin interior temperature as much as eight degrees. The MAES aircraft will receive their new paint during January outfitting cycle re-equipping throughout 1972.

► Lockheed Aircraft recently limited its stitching in an aircraft material which said it was now developing aircraft using six different kinds of power, but aimed only from reciprocating engines, turboprops, jets and rockets. It says "it means the various gases from each of rocket, engines as the increased pressure means will turn out to be complex and possibly adverse power."

and aircraft loss through observations on the outbreak of hostilities.

• All aircraft production is compared to Soviet aircraft production.

According to a reliable source, Renault produced 750 jet bombers and also to 6,000 MIG-15 or improved jet fighters last year compared with U.S. production of 50 B-47s, reported to amount to 300 this year, and a "few hundred" B-5bs.

• Quantity and quality of aircraft are in production and future prospects.

• Capabilities of the current production program and plans that have been taken to break the bottlenecks.

AF Acquires Aircraft For Jet Test Base

Palmole, Calif., April 1, in Los Angeles County is being assigned by the Air Force for conversion to a major base for production testing jets.

AF officials say that when completed the facility will represent a total investment of \$10 million. Current money totaling \$20 million has been used for land acquisition and test facilities.

In three major aircraft programs—1-reduced Northrop and North American Lockheed already has started operation of a new \$400,000 hangar built on the base through agreement with current officials. Cost of this project will be absorbed by AF.

Palmole is former Air Force base was selected for jet testing because of its isolation from population areas. It is located in the Mojave Desert, 40 miles from Los Angeles. Air National Command expects the facility to be in use within 18 months. At peak, 5,000 aircraft will be employed.

How Good Is France's Mystere?

An MSA release boasting it beat F-86 in "duel" is toned down considerably in Air Force interpretation.

What began as an endorsement press release by a Mutual Security Agency contract writer in France, on the receipt of the new Mistral Dassault jet fighter "Mystere," MD-452 has turned into a local hero in the U.S. Air Force. North American Aviation, and Mutual Security Agency.

The MSA release, dated last December, not only predicted a great future for the French fighter but declared that American test pilots found the plane "more maneuverable at high speeds than the F-86 and that the MD-452 gave a better showing at landing while landing."

The release was caught to an, however, that "in defense of the Sabre, officials point out that the Sabre, in a way, was never given the same test-production-like Sabre, used in the test."

• **Phase Dual-Mistral Secret:** Agency declared that the specified test was in effect a "Mistral Sabre" duel, which took place in the 40s high-altitude Mustang. France (and) involved two of America's greatest test pilots, Brig Gen Albert Boyd and Vice Commanding General, Wright Air Development Center, Dayton, and Maj Charles E. Yon, the man who has flown later than any other known being.

"For the first time, the American pilots in these Sabres recorded the French ship which was piloted by Raymond Beger Corporation, a son of the Fox, French Navy, later, Yon.

was the driving of Sabre to become the first American to fly the Mistral Under his and General Boyd's hands, the Mistral broke its own records and stole the performance show from the American Sabre jet."

An Air Force, put in the highly positive of having to defend the reputation of its jet carrier production jet fighter and at the same time not offend the dignity of another friendly nation's best jet product, agreed to join with the release which had been sent to the MSA.

• **Depth Involvement:** In an official statement, Air Force admitted in behalf of Brig. Gen. Al Boyd that he and Yon had evaluated the French fighter for the French government and delivered it "an excellent aircraft."

Boyd said, however, "that several details of an account received by the Mutual Security Agency concerning test flights made by the Mystere in France and Yon were accurate."

Specifically, Boyd said, "Test of the Mystere did not include simulated combat and that no attempt was made to test the relative maneuverability of the Mystere and the USAF's F-86 Sabre jet."

According to the Air Force, two F-86 Sabre jets were used in the tests at Mungton to check the accuracy of the speed section of the MD-452 and to observe the French fighter in flight. Both Boyd and Yonger took turns flying the MD-452 while one at both of the

F-86 fighters served as pace out at various places.

Boyd's checking the speed section of the French fighter, the Air Force explained, the F-86 enabled the observer to check vibration, operation of control surfaces, and aerodynamic stability of the Mystere, and to detect any difficulties which the pilot could not observe from the test plane's cockpit.

• **No Comparison:** An Air Force spokesman and that Boyd and Yonger had represented the Air Force at the request of the French government to evaluate the new fighter by American standards and that no test comparison between the F-86 and MD-452 had been made either officially or unofficially.

The Air Force said that Gen. Boyd and Maj. Yonger, both concerned that the Mystere is an excellent airplane, had recommended its production to the French government.

The Mutual Security Agency said that assembly line production of the Mystere would begin in April and that by the end of 1952, with the help of more than 55 million worth of U.S.-supplied machinery, the Dassault company would be producing about 10 jets a month.

The Mystere is now in limited production at the Bordeaux plant assembly plant of Marcel Dassault, Air Force Co. A delivery of aircraft ordered from the United States is completed, some 10,000 of the MD-452 will be a joint project of an other French subcontractor by itself subcontractors.

The plane which is said to have a performance capability falling somewhere between that of the Republic F-84 and North American F-86 weighs approximately 12,500 lb. and is powered by a single Pratt & Whitney Turbo-Prop engine, 3,000 hp thrust.

Army Plans to Fight For More Air Funds

Army aviation, which took one of the worst beatings in the whole 1953 defense budget from a defense department made in Secretary of Defense Robert Lovett's office, is going to put up a fight.

Joint Chiefs of Staff had approved a program to increase conversion and major helicopter for Army aviation after the notable performance of Army aviation in Korea.

Army aviation estimated the cost of the approved step-up at \$200 million for the coming 1955 fiscal year. When the funds of emergency flow out Washington, though they are expected only the small 10 to 15% cutback. Instead, the \$241 million was increased to \$350 million and Army is still wondering why.

More Comets

• **Short Bros. to build jet carriers for de Havilland.**

• **D-H now has orders for 45 Comets, more in sight.**

(McGraw-Hill World News)

London—It is more to step up development and thereby take greater advantage of potential orders, de Havilland Aircraft Co. Ltd. has selected production of the Comet to Short Bros & Harland at Belfast.

Short's, it is hoped will have its first Series II Comet (two powered) of the production line in 1954. Before that, D-H hopes to get partly subcontracted in Belfast for Harland production.

D-H right now has 45 orders for Comets on its books, with another five or six in the making. But since aircraft, especially Sabre and KLM, have talked at the idea of ordering Comets to meet their delivery dates Sabre and KLM figure the U.S. may be the largest single buyer with a better offer to the Comet D-H can deliver Comets to Belgium and Holland. The present arrangement is designed to ease the threat to Britain's up-and-coming jet engine engine carrier.

• **Butte Labor Market—Short Bros., which was represented by the government during the war and is today Britain's one state-owned aircraft manufacturer, will be a major player in the West than D-H has at Harland. The deal points up the fact that the British government is giving production of civil jet and transport jets as high a priority as military types today. Recent the coming potential of Britain's jet transport beyond looks like a**

very welcome help for Britain's chronic balance of payments difficulty.

• **Short Bros. to build jet carriers for de Havilland.** Short Bros. (Short Bros.) Comet number eight is expected to fly in a week or two. Comet No. 20 has made its appearance in the production line at Harland. Short Bros. (Short Bros.) Comets have been coming off the line at the rate of about one a month.

BOMC has taken delivery of one Comet and will take delivery of two more within the next couple of weeks. A fourth Comet is on loan to BOMC now, but will be returned to Harland shortly for refinements.

BOMC will introduce the Comet on its London-Johannesburg run in May.

AIA Urges Changes In Patent Proposal

American Indians have told the House Indian Committee that the proposed Proclamation Rights Act, proposed April 1952, in Congress would give government agencies authority to choose validity of patents, thus changing patent law voted in federal courts.

An AIA spokesman urged that three provisions be incorporated in the bill as safeguards if the measure is to be considered.

• A standard government patent should be established for guidance of government administration.

• Power to reduce patents should be confined to the military services.

• If a patent is found to be invalid, it should not be subject to further action by the government at some later date.

Atom-Power Airframe Contract to Boeing

A signed contract for "engineering study of the application of nuclear powerplants to aircraft" has been awarded to the Boeing Aircraft Co. by the Air Force.

The Boeing contract is concerned with developing an airframe for the Pratt & Whitney steam engine development for which B-70 was awarded a contract by Air Force last year.

An earlier AF contract was given to Consolidated Value Aircraft Corp. for development of an airframe for the General Electric Co. steam engine development.

Air Force said that no details as to scope of entire program, or as to specific features of the powerplants under study could be revealed.



SUPER OUR SET FOR SHOOTING AND SHOOTING

This Free Super 8 film is available to all those with installations of an intermediate 16-mm shotgun, fitted in the landing gear. You need and a public display system. The camera controlled design, detailed in

photo, right, gun proves very effective in looking out eyes and noses, which you can easily attach. The low-profile system enables the shooter to shoot from a low angle, yes, to direct rounds in a variety

of positions and in looking shots. Landmark is not located under the wings nor in the outer struts. Sound and gun noise are shielded by built-in sound of Air Force, San Antonio Municipal Airport.

selected the best commander of the design of such a craft and even carried him back into action in practice exercises on military maneuvers.

"In the war that followed in the Pacific, it was demonstrated that control of the sea was dominated by carrier aircraft. There developed a strong feeling that the top Naval command should be held by Naval aviators.

"Due to the fact that most of the major aircraft were assigned and passed to the aviatorship of the officers, all that the present could accomplish was the adoption of a policy that carried that force would be commanded by aviators and that other force command if not aviators, would be required to have an aviator as chief of staff.

"On the other hand, master flight officers, even if commanding a carrier task force, was required to have a staff aviator chief of staff or deputy. This policy left most of the top Naval command in the hands of aviators.

"And today, on wars after the war, with aviators of no less importance to the highest Navy jobs occupied by non-aviators."

CAA Requests More Funds for Personnel

Out of hundreds of government of fees that had ceilings put on three expenditures for personnel this year, Civil Aeronautics Administration is one of the few that has new rate made and is now requesting a lifting of the ceiling.

"The aim of the provision is to hold down non-military government em-

ployment and the political influence that goes with job protection.

CAA was appropriated \$22.5 million for the establishment of an organization for this year. But it was stipulated that not more than \$1,000,000 be spent on personnel. In Mid-February, CAA suddenly discovered that this amount wasn't going to last until the end of the fiscal year, July 1, and borrowed some \$20 employees.

CAA Publicity—Now CAA wants Congress to lift the ceiling to \$1,500,000 and House Appropriations Committee has approved on the basis of CAA's report that this will save the government money.

CAA passed the war for its suitable compensation action with publicity to the effect that some 75 managerial aids will remain after throughout the course of the ceiling is not lifted.

This is the explanation given the House Committee by Deputy Administrator F. B. Lee.

CAA's Washington office keeps projects to regional offices and leaves it up to the regional office to decide whether work will be performed by CAA personnel, under contract, or in direct contract (under which CAA must furnish employees with personnel). Since account workers, as well as CAA personnel are paid out of CAA's allocation for personnel.

Lee said "The Air Navigation Facilities program traditionally has been allocated to obtain the best results for the least cost. Consequently, under the decentralized program structure policy now in effect, projects are assigned to the region and the regional officials are charged with the responsibility of obtaining the most economical and sat-

isfaction, method of accomplishing these projects. In this, they may use direct contracts, contract services, and/or the employment of regular personnel to accomplish the program on the most economical basis without regard to cost by the Washington office.

• Since the Washington office doesn't know how much work regional offices do in contract, it is not in a position to know how expenditures for personnel are going.

Lee said "Unless the CAA depicts from this policy (of giving regional offices freedom to accomplish projects either under contract or by regular CAA personnel) it will not be possible to accurately document personnel and cost requirements, since the regional offices will vary with the number of projects accomplished under contract."

• Nevertheless, CAA has developed "direct charges" in the administrative control of its program.

• Before asking for the lifting of the personnel ceiling, CAA considered doing more work in contract. But Lee said "It is the opinion of the agency that such action would naturally increase the cost of the projects even if it were possible to arrange contracts in all locations."

• Unless the personnel ceiling is raised "We will have to go through a considerable reduction in face and pay removal leave for employees who will be separated which will result in expenses in the government without production later in the amount of \$150,000."

AA Asks CAB to Up Fares \$1 Per Ticket

American Airlines has notified the airlines that it will file an application asking CAB permission to charge an extra dollar for every ticket sold and to suspend conspiracy discounts effective Apr. 15.

Washington observers report that CAB does not favor a fare increase now. However, they say the American move is the first clear signal of rising prices. The Board toward quick action item, if costs continue rising.

One indication of CAB's determination to hold fares down is the recent suggestion of a Western Air Lines fare increase to 77 cents a mile on non-stop flights to comply to smaller routes.

Officials of CAB Rates disagree that the American Airlines rate has higher fare is not likely to shake CAB resolve to hold fares down.

Despite the new rate, a CAB official said the airlines have not demonstrated that their cost is earning a fair return on investment. And attempts of up to 15% last year are a violation against transportation prices now be and

AERONAUTICAL ENGINEERING

NACA Probes Into Tandem-Rotor Control

- Lab draws a "horsecollar" in its rotor research.
- But this may point way to directional stability.

By David A. Anderson

A "horsecollar" is helping to solve one of the stability problems of a twin rotor helicopter flown by pilots of the NACA's flight research division.

Placed around the forward fuselage of a Pavee HRP-1 rotor on loan to the National Advisory Committee for Aeronautics the "horsecollar" increases the static stability of the rotor in yaw. Actually the collar is a metal strip which acts as a spoiler and makes turbulent air flow along the fuselage. And it's a typical test fix—it was installed to solve one special problem, regardless of the other effects it might have.

Use of the collar is just one phase of a series of flight tests now being made by the NACA's Langley Laboratory. The overall program is helicopter research, specific use of the current group of tests is the development of landing quality requirements for tandem rotor helicopters.

• Single-Rotor—Basic—Control U.S. Navy requirements for three qualities of rotorcraft may well establish two years ago with the entrance of the NACA. They were based mostly on studies of single rotor craft such as the Bell and Sikorski rotors.

Now the problem is to see if the characteristics apply to a tandem rotor configuration. If they don't, it will be the task of NACA to recommend new or modified standards which will be applicable.

The Pavee "Flying Banana"—the wordmark for the NACA flight—was loaned to the Bureau of Aeronautics. That was not to imply that the craft, but to use it as an example of current practice in tandem rotor design. Test data from the flight is hoped to be useful and applicable for an tandem rotor, an incident by of knowledge can be in support of the specific qualities of the Pavee design.

One characteristic which has been noted already (the HRP-1 has sufficient directional stability—hence the horsecollar).

• Large Effect—The rapid response of the helicopter industry from a base of



HORSECOLLAR is metal rotor strip to create turbulent flow along HRP fuselage for increased directional stability. Temporary boom on rear rotor device to measure airspeed, angle of attack and sideways angle. Rotor in being flown by NACA pilots.

expensive design, coupled with the combativeness variation of the wind itself, has led to tremendous research effort on the part of the various and non-military. An example of the magnitude of that effort, the full-scale wind-tunnel at Langley develops instead of its test hours to studies of helicopter configurations.

Langley has been on the way, even research techniques for over 30 years. They started with flight tests of a fixed wing rotors and have been actively engaged in rotor work ever since that time.

Even before flight testing of helicopters began NACA published an initial performance studies of rotor rotors.

In the summer of 1944 a single rotor Sikorski HO-4 started the first helicopter flight test program at the NACA. Three years later, specific studies of performance stability and control were underway.

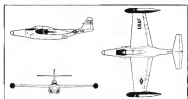
Other branches of NACA branch flight research and the wind-tunnel

groups get into the control test. There is a large outdoor helicopter test where full-scale jet and conventional systems may be tested. And recently a new building is under construction. It will have a large wind tunnel and free flight tunnel.

• Instrumentation—The control tests of the HRP meant lots of instrumentation. A large volume of the rotor now has been filled with recording instruments. These give a continuous time history of acceleration, vibration around stability, yaw and control problems.

Since the Pavee test started at Langley it has been flown by John F. Booder and James B. Whitman, both NACA research pilots. First job they did was to study the longitudinal characteristics of the HRP—how it behaved with the nose down and below the horizon.

Recent reason for this study was what a Lawson as longitudinal divergence. That means that if the aircraft is being along straight and level, a small nose up



NORTHROP F-89D SCORPION DETAILS

Characteristics of the Scorpion two-seat all-weather fighter are shown in this three views recently released by the Dept. of Defense. The Scorpion can be spotted from almost any angle by the mounting of its two jet engines against the sidebooms, the noticeable angle of the leading edge of the wings in high-mounted tailplane, the long, tapered

nose. Other distinctive features are its well-winged delta and almost flat front and top edge of the head wings. Span 56 ft. 7 in., length 51 ft. 4 in., height 17 ft. 7 in. Top speed is over 600 mph. Armament is in 28-mm cannon which are located in nose. The F-89D carries rockets in wingtip containers.



HRP AND PILOTS Jack Beebe (in cockpit) and Jim Whitson about to take off on one of a series of flight tests on tandem rotor configurations at the Langley Laboratory.

INSTRUMENTS The measuring and recording flight data are installed in test fuselage of F-86D replica. Kenneth Arner, NACA engineer, checks electronic instrumentation.

or nose-down variation from the flight path should not move the cue to rise or fall sharply away from straight and level.

The way you make such a study is to fly the cockpit under different conditions of power and center of gravity position. After you establish steady flight, you make a sudden pull-up. If it happens up beyond your event horizon, you have longitudinal divergence, at least in one form.

Of course you have to compare the pilot's opinion with the recorded data, and when the NACA did that, it was found that the HRP was a typical tandem rotor cockpit. The stability—as reflected in divergence—increased as power was increased and as the center of gravity moved aft.

► **Tandem Unhappy**—Placing one rotor behind the other creates much more turbulence. It does not fly like you pass through the influence of the first rotor before reaching the second. The front rotor increases the downwash angle and increases the rotor inflow. Thus the aft rotor is working with reduced lift curve slope (because of the increased downwash) and nearer to the tip stall (because of increased inflow). Both these factors reduce the longitudinal stability of the rotor.

But stability can be improved with the configuration. All you do is position the center of gravity forward.

Another study now in progress is the determination of how much static directional stability is necessary. Directional stability is necessary around a

vertical axis through the aircraft CG and is a static indicator the right and left steering ease of the cowl.

The tandem rotor arrangement generally has less directional stability, due to the high moment of inertia in yaw. ► **Control Springs**—In flight, uncoordinated motions of the cowl plus their interaction are impossible to prevent. But for flight tests, it is still necessary to maintain fixed control positions, frequently at the neutral position of the control. So spring devices were installed to help the pilots center and hold the controls.

In one evaluation of handling requirements, there is a necessary much dependence on pilot opinion. And if the range covered is limited, there is a chance that the pilot's comments will be affected. So generally the attempt is to make stability, for example, from a condition where the aircraft is so stable it can hardly be controlled to a state where it is nearly a catastrophically unstable.

In these rotor tests, several methods were used to vary the directional stability over a large range. Different power settings were used, because the directional stability varied directly with power. Incidentally, although added power improves the directional stability, it reduces the longitudinal.

► **Human Adaptability**—In one test method the cockpit was used as a human autopilot in an attempt to obtain the equivalent of a fuselage as close to directional stability. For this different approach the cockpit and an

indicator which told him the amount of rolling angle. When he rendered to adjust the indicator, it fed an opposing signal into the indicator and showed the reduction. The co-pilot's job then was to keep the indicator reading zero, which meant that there was zero side slip.

When the pilot was ready to perform a typical test roll maneuver, such as sharply deflecting and holding the lateral control, he took his own test from the pedals. The co-pilot then attempted to keep the indicator zero.

But it was at best only an attempt. Sometimes it ended very so rapid that the co-pilot could only keep the indicator needle centered for short periods of time.

Then came the "torpedero" in wind-tunnel tests of a fuselage could spool down as the nose increased directional stability. The spoiler, a metal strip which projected about four inches outside the fuselage contour, rotated radially along the fuselage from the rotor aft.

So on to the HRP went the yaw rotor, and it definitely increased the static directional stability. It also did not much increased the drag.

► **Sail-Now Problem**—The tandem configuration aggravates another problem, that of adverse lateral-directional stability. In recent years, NACA has studied that stability problem for airplanes, and has discovered that stability-equation terms which were previously disregarded actually have important effects on Dutch-roll stability under



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certain conditions. You get these conditions when the flight path and air plane intersect but do not coincide, and when the instant of inertia is low as high compared to the moment of inertia is roll.

The helicopter is powered forward, flying sideways, has its principal axis tilted down with respect to the flight path.

This condition is where the regulated term (product of inertia) has no net disturbance. And the tandem engine approaches due because its moment of inertia is low as high, and is roll, it's low.

Both of these flight factors lead to certain Dutch roll instability. Dutch roll, although best described with the bands, is a combination of yaw and roll. The airplane swings to the right and rolls a little to the right, then tilts out and crosses the flight path to swing and roll a little to the left. The process is repeated at a fairly slow rate, in the order of one cycle per second.

► Safety Dividend—All the NACA research is aimed at the development capabilities of the engine. Under the direction of Melvin N. Gough, chief of the flight research division, and Professor E. G. Gostelow, NACA's top specialist in rotary-wing design, these flight investigations should lead to extended capabilities of the engine.

These stability and control tests will make the rotary-wing roll safer and easier to fly over an increasingly broad range of conditions. And enhanced research will enable the helicopter to realize its full potentialities in all weather aircraft.

Missile Spin Force Measured on Model

Force due to the spinning of a missile are now being measured on a rotating model in the Naval Ordnance Lab's spin-tunnel, White Oak, Md.

The spinning model is powered by a top, frequency-controlled electric motor, designed and built specifically for the purpose by General Electric Co.

In the past, data for rotating projectiles have been determined from tests of fluid models, corrected for rotation by certain assumptions. This method is, of course, not as satisfactory as direct measurements, since correlation of model and free-flight tests is difficult.

Currently, NOL is using the spin-tunnel to check the effects of control aids force on the boundary layer which influences both skin friction and base pressure drag. Studies have been made for Mach numbers between 2.5 and 4.5.

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AF Develops Safer, Lighter Parachute

A new personal parachute, featuring automatic opening, low opening shock and reduced complexity, has been developed by the Air Research and Development Command's Wright Air Development Center, Dayton, Ohio.

Currently undergoing jump tests by AF personnel at WAGC is the C-100, C-101, Parachute Development Test Group, the chute will probably become standard for the Air Force.

One feature—Ductless—of the chute canopy is 25 ft. Twelve triangles in the canopy reduce the canopy's surface area to 25 sq. ft. to reduce opening shock and to lower opening shock.

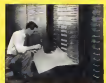
There are two advantages gained by lowering the opening shock. First, there is less chance of tearing the chute when the canopy opens, second, since opening shock is reduced, the chute itself can be lighter because of the reduced strength requirement.

And reducing the opening shock also decreases the jumper's chance of injury caused by his being swung into the ground.

The chute assembly weighs 22 lb., which, says the AF, is more than 10% weight saving over present parachutes. Part of this weight reduction comes from the substitution of rods for the steel struts which had been used to give contour to the pack.

Automatic opening equipment can be used for a specific time delay. The chute can also be opened manually in the usual way.

The harness has also been simplified, it now resembles a put on like a vest. There are only three ad-



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payments to make instead of the seven now current practice.

This change is the result of an eight month development program at WADC and TO Canada.

British Push Work On Plastic Delta

The all-plastic molded wing developed by British scientists will go on display at the British Industries Fair this spring. First shown at the 1951 Society of British Aircraft Constructors flying display at Farnborough, the wing is actually a prototype model for the Fairey F.D.1.

Coinciding with the announcement of the BIF showing, the British have released much more data on the design and construction than were available at the time of the Farnborough show (AIRCRAFT WEEK Nov. 16, p. 23).

■ **Claimed Cheaper**—The British claim that the technique involved eliminates the two biggest cost factors in plastic production—steel dies and high-pressure hydraulic machinery.

Basic material is acetate fiber bonded by a resin, large soft sheets that resemble felt and the result. Alternative materials for experimentation were films of cellulose, paper and glass.

One molding technique is very simple, the sheets are laminated with warm water and rolled by hand over a wood or plaster shape. The resin is added to lock the films in position, and the whole works is cured in an oven.

For more complete structures, the roller-bag process is used.

The complete wing is made in two sections in order to get a glass-smooth skin. The sheets of acetate felt which form the outer surface are separated from those forming the inner surface by layers of glass cloth and cellophane. After the first molding operation, this outer layer is peeled off and attachment bolts and rivets are inserted in the proper locations in the next layer.

The outer skin is replaced and the final molded which seals the skin flat on top of bolts and rivet heads.

Final finishing is by sanding; the wing is coated with a filler resin and then polished to a high gloss.

Fellowship Open

University of Wichita announces that a graduate fellowship leading to the master's degree in the field of aeronautical engineering will be awarded for the 1952-53 school year.

Stipend will be \$1,000 plus tuition and fees.

Details may be obtained from the Committee on Scholarships and Student Aid, University of Wichita, Wichita 14, Kan.

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Gilfillan GCA is the first navigational aid to be adopted as standard by 24 United Nations Allies.



EASY TESTS which preceded first flight last December show off money savings, conventional lines of Fiat's first turbojet aircraft.



FORWARD FUSELAGE is reminiscent of Lockheed T-33. Interlocking points, boundary layer, smooth scope, light weight, design.



WING STRUCTURE is cantilevered, two-part with multiple of strength. Panel is divided at outboard end of flap into two sections.

Fiat G 80 Follows Conventional Lines



REAR BULKHEADS in jig show fuselage construction and integral ribs, vertical fin, right. Partially completed fuselage of trainer-fighter, left.

Italy's first turbojet aircraft, the Fiat G-80 trainer-fighter, is an archetype of conventional design practice.

Illustrating by the lack of research facilities, the Fiat design team under the leadership of Prof. Gaberelli had to hew closely to the line of normal air frame design practice. Their approach is best shown in three photos depicting several constructional phases of the G-80.

Note, for example, the simple external reinforcing angle between stub fin and fuselage, and the way the tail assembly is built up from stub fin to stabilizer in vertical fin (photo at left).

And notice the way that wingtips at attachment clips and tail cone support angles extend the full depth of the rear wing members in design construction. Current version of the G-80 (Aviation Week Jan. 14, p. 21) is powered by a British de Havilland Goblin 35. Span is 34 ft., length 40 ft.

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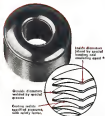
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Canadian Blue-Inkjet Copied from P. 10, P. 11, P. 12, 1951. Issues in Glass of the International Association of Glass Technicians.

Eighth Viking Rocket Has Triangular Fins

Martin's eighth Viking research rocket is out to break the altitude mark of 155 mi set by an older leader, Viking 7, in August, 1951. And Viking 8 is expected to better the second height by a considerable number of miles.

To do this, Martin and Naval Research Laboratory engineers redesigned the basic rocket with increased diameter, reduced length and reduced and reshaped the area.

Main purpose of the change is to increase the storage capacity of liquid oxygen and alcohol for the Rocket



Motor, has 20,000 lb thrust rocket engine. Main fuel motor longer burning time, and that in turn raises higher altitude.

► Big Change—Most noticeable variation from earlier models is the triangular shape of Viking 8's fins. Originally triangular, the new fins have about 75% of the area used for the first seven rounds. Presumably control will continue to be by means of the thrust area, earlier models had an external tab on each fin to correct for the misalignment of that fin. And the rocket was steered, during powered flight, by swinging the motor on a gimbal mount.

Fineness ratio of the rocket has been decreased from nearly 19 to a little more than ten. Viking was just short of 90 ft. long (or high) and had a

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Of interest to all segments of the aircraft industry is the fact that the Continental R-975, as redesigned for helicopter use, is now in production at CAR, for such craft as the Sikorski HO4 and HO4 II and the Kaman HO4.

The compliance with which this air-cooled radial, rated at 325 h.p., has met the helicopter's high performance standards, suggests its choice for other seating applications as well. It has special significance for manufacturers of conventional planes.

It offers them a power plant with an extra margin of stamina,—a margin proved by performance under conditions for extra stress, then are imposed on the engine of an airplane of fixed-wing type.

There are employment opportunities for engineers and others desiring to make a career in the field of small turbines for commercial and military use. Write giving your background and the type of work desired.

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British to Build Co-op Windtunnel

Eleven British aircraft and engine companies have begun a project to design, build and operate a co-operative transonic windtunnel which will be the largest in Britain.

Registered under the joint name of Aircraft Research Association, Ltd., the member companies are currently negotiating with the Ministry of Supply and other authorities for the site, power supply and other services.

Project was initiated by the Technical Board of the Society of British Aircraft Constructors, which reported that the progress of aircraft design demanded a transonic windtunnel.

One use only between the limits of free-stream Reynolds numbers in Britain, possibly one contribution to the high diffusion rate of British prototype aircraft.

The member companies are: Blackburn & General Aircraft Ltd.; Boulton Paul Aircraft Ltd.; The Bristol Aeroplane Co., Ltd.; The Farnley Aviation Co., Ltd.; National Aircraft Ltd.; Handley Page Ltd.; The Hawker Siddeley Group Ltd.; Rolls Royce Ltd.; Saunders-Roe Ltd.; Vickers Armstrongs Ltd.; and Westland Aircraft Ltd.



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And so they designed and constructed one, the first of its kind, for servicing the rocket powerplant of Republic's SR-71.

► **Fast Performance**—There have been many fueling techniques as there have been vehicles to take the fuel. In the case of mobile, liquid oxygen and also fuel to feed the powerful rocket engines.

are fed into tanks at a low rate, either by pump or by pressurizing gases. Fueling takes hours in the case of the V-2.

The Bell X-1 was fueled with nitrogen pressure to force the liquid oxygen into the ray craft's tanks. Pumps of sufficient capacity weren't available. And the Douglas D-558-2 Skyrocket was fueled with oxygen at a moderate rate and then trucked to the test base. And in the case of both airplanes, skid and pressurizing nitrogen gas was carried in separate operations from portable tanks.

► **Fast Performance**—Republic's truck



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REACTION MOTOR rocket engine for Republic's XF91 is set up here just as in the aircraft. Pennsylvania engine develops 6,000 lb. thrust, powered Bell X-1 and Douglas D-558-II on their record breaking speed flights.

The large tank at the rear of the truck holds 900 gal. of liquid oxygen. It is double-walled and insulated. At the forward end of the truck, both on a centerline, is a smaller tank which can hold

An Air Force B-1 engine-guaranteeing is built on the body, and a six-cylinder system is also included. A compressor and electric pump complete the list of auxiliaries.

Weight of the entire trailer truck is 1.24 tons. As few as two rats can operate the rig.

For more powerful engines, equipped with profile improved safety and performance devices, were anticipated for the future by E. B. Newell, general

managers of the Alliance Div. of General Motors, in a recent talk to the Society of Automotive Engineers at Detroit.

to 50,000 hp, will be built," he predicted, "and the aircraft in which they will be installed will be operable by one or two men. We are now thinking in terms of aircraft power equal to that of destroyers or smaller cruisers a few years ago."

► **Developments**—As proof of his expectations, he sketched in what has happened in the years since World War II, noting that Alliance IVG threat

per pound of organic weight rise from 1.5 to 2.42, and j-71 thrust per pound rose to more than 7.0 with afterburner. Overhaul cycle time on the j-35 has risen from 18 to 100 hours.

Afterburners, Newell indicated, would do much to augment thrust. By use of excess cooling air he pointed out, thrust can be increased one-third, although it results in high specific fuel consumption; the combined thrust is

To improve speed and climb performance, in the future, Nevill suggests four lines of approach: greater thrust-to-weight ratio, all-attitude, retractable air inlet screens, and better materials.

We mist across function well on the ground, is noted, is difficult against gravel, but reduce the amount of as forested in during flight.

Range means, another long-term objective of the jet makers, is core provided in Newell's thinking of higher efficiency of the engine com-

► **Higher Pricers**—Competition rules have gone from 3.5 to 5, he noted. And he saw, on reason why there should not ultimately rise to a level of 9 or 12 put as in Otto's call on rates.

Improved safety and durability, he suggested, would come about through elimination of vibration, better bearings and lubrication, adjustable wheel-axle assembly, air deflection, better

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11

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materials, and improved mechanical design.

He discussed the engines in Italian but none of a number of Republic F-84 Thunderbolts in an Air Force inventory, among them were covered by sudden news, into a maintenance area and subsequent almost automatic way, being inside the jet, cutting off fuel leads. As no detectors of some sort—be offered no specifics beyond the idea itself—would aid in intercepting such conditions.

He indicated strongly, by use of comparative engine studies, that the most accurate approximations the turbo-prop engine is not more practical than

the turbojet. Speed, he noted, is not so great, but range is considerably further, and the speed increase is not too severe as things now stand. His tables also indicated that turbo-prop engines give aircraft more speed to that of reciprocating engines, and at higher speeds.

How much for jet engines against traditional powerplants? This question was put from the floor afterwards. Nieuw estimated that a 2,150-hp. jet reciprocating engine was made in small quantity by Allison and sold for about \$12,600. Jet engines producing thrust equal to about 6,500 hp were being built for about that same size,

he reported. The quantity of production, he said, that latter price might be halved.

Answering another question, he indicated that the market for smaller turbine engines, on the order of 150 to 200 hp and using two combustion cores rather than eight or ten, would be limited mainly by fuel consumption problems.

THRUST & DRAG

Maurice Smith, editor of our excellent British contemporary, Flight, has just sent us a worthwhile little booklet called "British Aircraft to Scale." Most of the material is updated from the special issue Flight published on the occasion of the 1951 Farnborough show. Maurice says that the folder contains practically all the figures which would be printed at this time.

And on looking through the pages of drawings by Russ Jones, and scanning the spec tables at the end, I'm inclined to agree. So it could be a handy collection of planning drawings of all the current British aircraft, rendered in the same scale, plus tables of dimensions and performance, sent to Rifle & Sons Ltd., Direct House, Stamford Street, London S.E.1. Price is 1s.6d., which reads out to about 21s.6d. however, and sending a quarter would pay the postage and handling, I think.

Indeed Doug Cockfield moved for the week. To Mr. Ken H. Rice, North American Aviation engineering vice president. Mr. Rice, recently speaking of the difference between MG and Sabre was quoted as saying that the MG has a real character—light control system comparable to the Mustang. "Therefore, we are in a position to know that this type of system is correct regardless of the engine's operating speed." But Mr. Rice didn't say that the Mustang was better than the Sabre, nor that "with its inadequate" control system to control it over North American's B-45 jet bomber, Boeing's B-29 piston-engine bomber.

Recently we received the first issue of the new Dutch aviation magazine, *Aviatie*, published, official organ of the Royal Netherlands Aero Club. Naturally it is written in the Dutch language, but which—if you understand technical German—you can make some sense. Chief recommendation is a magnificent cartoon of the Lockheed L-1049C Super Constellation by Rudolf Das. The magazine is to be published every two weeks. If Das material is to appear regularly, that would seem to be sufficient reason to subscribe. Editorial offices are at Anna Paulownastrasse 3, The Hague. —DAA

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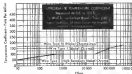
Of all the components that make up avionics equipment, resistors are among the most important. Yet, because they are insignificant in size and price, this importance is too often overlooked.

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For instance, one of these new products soon to be made available for avionics equipment—

The New IRC Type BOC Boron-Carbon PRECISTOR



Here is the ultimate in stable, reliable non-wire wound resistors. Exposed to a temperature of 65°C for one hour, newly developed BOC shows a

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AVIONICS



NEW TYPE TRANSFORMER (left) and old have the same temperature rise characteristics but only the size difference made possible by turbulent cooling.

How to Keep Cool and Lose Weight

Turbulent air flow around equipment sharply raises heat transfer efficiency and may permit 50% weight cut.

By Philip Klaus

A new technique for getting rid of heat generated by avionics equipment has been developed which offers an attractive solution to current high heat power operating problems. The new cooling approach may also permit up to 50% reduction in the overall weight of a avionics equipment.

The development, known as turbo hot air cooling, was described by Lawrence Katz of the Raytheon Manufacturing Co. in a paper presented at the recent annual convention of the Institute of the Aeronautical Sciences in New York City.

► **The Problem**—With the growth as unceasing use of electronic equipment the amount of heat to be dissipated has grown. As flight altitudes go up, aircraft air density drops, less cooling medium. Higher phase speeds cause rise in temperature, lowering the difference in temperature between the cooling air and the equipment to be cooled.

Self-initiation, however, has aggravated the problem. Growing heavier components in a fraction of their previous size doesn't reduce the amount of heat to be dumped—only the effective cooling surface area.

► **Weight Reduction**—Application of this new turbulent air cooling should save weight if possible to reduce the size and weight of certain avionics components, like transformers, by more than 50%, according to Katz. They support more transformer capacity in a similar portion of the weight and size of avionics equipment.

The new technique is a result of a USAF-sponsored project at Raytheon. Their study of cooling heatpipes upping innovations, forced air cooling indicated that heat transfer efficiencies were only 2 to 10% (Heat transfer efficiency is the ratio of actual coolant temperature rise to maximum possible coolant temperature rise, i.e. to the



► **Temperature Rise**—Heat is transferred in efficiently that the cooling plate temperature rise is limited to 10°C above the cooling air. Temperature rise of components within the class is limited to 5°C above the cooling plate temperature, or 15°C above cooling air temperature.



► **Smaller Transformers**—A major factor in determining transformer size and weight is temperature. If the heat generated in the core and windings can be carried away more effectively, the rating of the transformer can go up, or the size and weight can come down for the same rating.

Raytheon has checked this problem by building copper conducting tubes into the coils and core of a transformer to carry off the heat to the cooling plates. Using these techniques, Raytheon has constructed a 1,700-wa. 5 phase trans-

formation of the last body. The use of turbulent air flow cooling suggested itself because it reduces the amount of stagnant air layer impeding heat transfer between a hot surface and cooling air. At a Reynolds number of about 2,100, laminar flow becomes turbulent flow. When this happens, there is a sudden and amicable improvement in the heat transfer coefficient. Once more important, once the turbulent flow condition is reached, a further increase in air velocity gives almost three times as much cooling as the same increase would achieve under laminar flow conditions.

► **Practical Applications**—By moving outside air through metal tubes at a Reynolds number considerably in excess of 2,100, practical use can be made of turbulent air flow cooling. These metal tubes form a part of a metal base, called the cooling plate, which in turn mounts the avionics equipment. The air passages may be formed in the end cap plates by milling or by fabrication.

With this technique, a heat transfer efficiency of 70% can be obtained with such a 1 psi pressure drop in cooling air passage, an efficiency of 90% has been obtained in some models using a 10 psi differential pressure.

The remaining problem is to transfer the air through the tubes to the cooling plate. This is done largely by metal-to-metal conduction. Tubes, as tubes, capacitors, etc., are buried and sealed in cylindrical holes in the wall of a thin metal casting which serves as the chassis. A large center opening in the casting accommodates large components such as transformers.

With this technique, components within the casting is transferred, largely by radiation, to the cooling walls. Convection is purposely avoided to prevent hot spots. Once the heat is transferred to the casting, conduction carries it to the cooling plate and thence to the cooling air.

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**Organization/Location in the Family Care
Environment & Work Setting: Interview**

factor whose weight and volume about 1/3rd of a standard transform of the same rating.

Maximum temperature rise of the mesh designed transformer is 21 above cooling plate temperature, or total of +9°C above ambient cooling rate. And Raytheon claims that even further improvement may be possible.

Conservation, making allowance for the added weight of air ducting, expansion joints (required at least one temperature to provide 60 deg wt). Kate and his associates find that an overall system weighs very little; saving of 90% is possible using test hut as cooling.

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presented to the pilot as a series of visual indicators. The signal could presumably be fed into an autopilot to provide automatic adherence to straight-line flight. Flight tests of the new device under manual control are reported to have given flight path deviations as low as 0.03 mrad.

Collins Navigation Aids Go in GM Fleet

Caltex Refin Co. expects a firm order for its new VHE wheel steering equipment (competitive with the Spax Zero Rudder and Bendix Orientation) has been placed by General Motors Corp. for installation in its executive aircraft. The order is for 19

Sample described the eight-point pattern for the pilot law position. A letter to his chosen crew, and close him how to strut to approach smoothly and stay on course. It is an integrated system, combining basically of a steering computer has, and two visual aid in the cockpit—a "Course Indicator" and "Heading Indicator." The crew

Cotton says pilot production on 90 sets already is underway and that full-scale production is expected to start in the latter part of the year.



Light Oscillograph

A new small lightweight 14-channel recording overograph has been announced by the Wisconsin Geophysical Laboratory. The unit, called Model 515, weighs 12 lb. operates from 24 V. a.c. and measures up to 35 in. span.

The oscillograph has an electronic timer which places timing lines on its recording paper at 31- or 33-second intervals chosen by selector switch. Chart paper speed is continuously variable between 1 and 12 in. per second. Galvanometers are available with an designed natural frequencies ranging from 100 to 5,000 cps.

Two more models are available in two different models: one has a 50 ft. magazine, the other holds 100 ft. of paper.

Midwesters Geophysical Laboratory
Tulsa, Okla.

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Production Rising, Profits Lagging

Year-end reports indicate that industry's 'get-ready' period is just about over; 1952 should see new peaks.

By William Kroger

Outstanding characteristics of aircraft manufacturing in a rapid build-up period are being sharply defined in annual reports for 1951 now being received, and future trends not being pointed, shown.

Three of the most prominent factors in the industry are weakly delineated by these recent reports. How slowly output rates in initial stages of a program can be judged from studying the Douglas Aircraft report. A reported three in the industry's future in federal tax policy is set forth by Convair. An example of how speaking out sets up revenue of large and small manufacturers alike dominates the report of Ryan.

But despite the problems and worries, executives of all three firms believe 1952 will be an even better year than last, which saw revenue slipping in cases, and backlog reach an all-time high for a period of no sell-out was.



Douglas

Perhaps the most significant figure in the report of Douglas Aircraft Co. for the year ending Nov. 30, 1951 is net financial. It indicates that shipments of airplanes and space parts for the fiscal year totaled 12,741,302 lb. In contrast the figure for the 1950 fiscal year was 7,251,080.

The 1950 report stated that 246

planes were shipped that year. A single estimate of Douglas 1951 deliveries is approximately 380 planes, or about twice the 1950 shipments.

• **Newly Ready**—This low level of production for a large company, contrasted with the company's belief that higher sales will be realized this year, tends to support the theory that the aircraft industry's "get-ready" period has about ended. This is also reflected in the size of Douglas inventories of the new aircraft program, particularly which more than doubled from 577,744,169 in 1950 to \$391,677,093 in 1951.

President Donald Douglas comments that the mounting inventories created a tremendous drive on the company's cash. "Additional borrowing may be necessary until that expanded production effort reaches delivery stage and the rate of expansion is reduced. The entire liquidation of inventories will begin to produce additional revenues." However, he gives no indication of when that step-up in production will occur.

The Douglas backlog was still rising, pushing inventory higher, as the fiscal year ended. It was \$1,635,271,000 as Nov. 30, \$1.5 billion on Dec. 31, with 4500 million representing commercial orders.

The completion of the backlog plus the duration of sales for the year seems to put Douglas in an extremely advantageous position in the commercial market. Of the \$225,171,226 in sales (Aircrafts: Whittier Mar. 5, p. 7), 28.9% was for commercial planes and space.

• **Tax Take-On**—The 1951 sales Douglas realized an operating profit of \$16,797,382, reduced to a net income of \$6,912,239 by taxes of \$13,684,357. The size of the taxes made an important difference. In 1950, Douglas had income of \$31,534,893, operating profit of \$13,714,440 and net income of \$7,214,140 because of the smaller 55 million tax bill.

The report says that more DC-6 type planes have been bought by commercial operators than any other airplane in its class, that DC-6 orders total 150 and that 100, with 34 orders have purchased 349 planes of the DC-6 series.

Douglas intentions to keep its rank

in the commercial market seem apparent in the fiscal statement that "during the year studies have been undertaken to determine the desired electronics and optimum configuration of the future jet transport." These studies have progressed to the point that a decision can be made in the near future and a development program initiated.

As is true of other annual reports now appearing, the Douglas document is draped in details of activities for the industry. Some highlights:

• **EC-601 and EC-602 transport** (DC-6A and Super DC-3) delivered to the Navy began last October.

• **F4D Silver Star**, interceptor that flew in January, 1951. Douglas says it is "the smallest and lightest-powered interceptor in its field." Air Force also is interested in the F4D. Plans in production of F1 Scorpions.

• **The transport Globemaster** is identified in the report as the YKC-124B, although a year ago it was referred to as the YC-124B. The KC designation for AT planes indicates an aerial tanker for refueling operations.

• **B-47 modification** is due to start at Tulsa this spring. By the end of the fiscal year, 30% of the annual production of the first block of B-47s was on hand.

• **Two major missile projects** for research, development, and production of "missiles and missile accessories" are being worked on.



Convair

Added by the tax laws that Board Chairman Floyd Cohen criticizes so pointedly and at length, Consolidated Vultee Aircraft Corp. landed in a net profit of \$7,793,524 for the year ending Nov. 30, 1951 on revenue of \$72,195,123 (Aircrafts: Whittier Mar. 11, p. 7). The \$53 million in federal income (Continued on p. 49)



NEW HIGH SPEED ENGINE PRODUCTION THE U.S. AIR FORCE'S FIRST FORMED BY A GE JET

THE FASTEST TEN YEARS IN HISTORY

Builder of the first U.S. jet engine, General Electric reports on latest developments since 1942

Ten years ago next week, America's first jet aircraft was put into use at General Electric's plant in Lynn, Mass. Six months later jet power took flight across a runway in America when the Bell P-59 Mustang, powered by one of those G.E. engines, took off at Wright Field and flew over 500 miles per hour. Fast! Jet-like acceleration, too, took place, as the speed of sound.

In World War II military leaders had given jet flight a top priority because they believed the conquest, lost or gained for a specific dream, anything had almost been reached. The only in-

vention was a new kind of power plant. So the Army Air Corps asked American industry to build a jet engine, based on an English design General Electric, chiefly because of its half century of experience in designing and building industrial steam engines and aircraft turbochargers, was logically chosen to do the job.

Now, ten years later, a lighter pilot can fly almost twice as fast as he could in 1942. That's because today's jet engines are 50 times more powerful than the 1942 model. Even more powerful jet engines are coming from General Electric today, thanks to such big steps.



JOB EXPERIENCE with more nations and more undertakings, proved the Army Air Corps to be in General Electric, for the first U.S. jet engine, G.E. Model A, later taken over by the Army Air Corps, General Electric's turbochargers, which made high-speed landing possible in World War II.

See you just your airplanes in...
GENERAL ELECTRIC

G-E JET ENGINES POWER ALL THESE MODERN AIR FORCE PLANES



Convair B-58. Intercontinental bomber. 18 piston engines, 4 jet.



North American F-104 "Starfighter." Intercontinental fighter.



Boeing B-52 "Stratofortress." Heavy bomber.



North American F-4E "Tomcat." First operational jet bomber.



Republic F-105. High-speed interceptor.



North American F-100. Interceptor.



North American F-102. Ground support fighter.

GENERAL ELECTRIC



FORERUNNER of the modern jet engine, the General Electric turbojet engine was developed in cooperation with the Army Air Corps and put into service in September, 1941.



RESEARCH and creative engineering help modern G-E jet technology. These technicians prepare to test components for critical new jet engines.

FASTER, FARTHER, HIGHER

Engines designed and developed by General Electric have powered more planes, set more records, flown more hours than all other U.S. jet engines combined.

Leader in jet engine design and development back in 1940, General Electric has stayed on in front. It has done so by constantly looking ahead to the future demands of the military and the aircraft industry.

Planes always want more speed. So G-E engineers developed a better jet engine that propels a plane at more than 12 miles a minute! They always want more distance. G-E made its engines lighter, reduced their fuel consumption and thereby helped to multiply jet aircraft range ten times. Yet today's G-E jet engines are the most powerful ever produced since their 1940 ancestors.

There is no let up in the pace. Even as you read this, G-E's atomic research is being conducted with jet engine experience. Its engineers are now hard at work designing an atomic aircraft engine for the Air Force.

You can put your confidence in—
GENERAL ELECTRIC

GE 1



WORLDWIDE SERVICE organizations, equipped in the industry, help keep G-E jet planes here in America (B-58 shown) and abroad (F-100 shown) operating at peak efficiency.



MASS PRODUCTION of jets in a facility at one of G-E plants. Every one of these is built to exacting standards and is tested before leaving the plant.



THrust or "push" of G-E jet is increased by afterburners, shown on this jet engine. Pilot can adjust thrust jets greater boost of speed in combat.



New and exclusive office procedures—using Remington Rand's unique team of Painted-Card Methods and Kardex

Visible Systems—give you the facts you need to get top production from available facilities... at least possible cost

2 ways to get more production—faster

1. Shorten the production planning cycle by getting firm schedules into the plant faster... and
2. Speed actual production by eliminating the causes of many delays on the production line.

Here's how you do it. Use Remington Rand punched-card machines to develop, correlate, sort and print the "mem" of facts you need for efficient production planning. It's the fastest method known.

Then, for effective control, put essential facts to a Kardex visible system. Kardex graphically charts the facts you need to determine scheduled requirements and control procurement, receipts and shipments of all parts and materials.

Users report these outstanding results. They streamline activities... meet promised delivery dates... keep all inventories in balance. What's more, they

secure all the facts they need to comply with government regulations on inventories and to report requirements under CMP. Most important, they get these facts in a routine procedure without maintaining separate records.

For Production Executives: New 80-page study, *Production Control Systems and Procedures* (211164)—outlines complex procedures for engineering, production planning and progress, machine load, material and cost management and control. Call the nearest Remington Rand Business Equipment Center, or write to Management Controls Reference Library, Room 1715, 315 Fourth Ave., New York 16, New York.



Remington Rand.

(Continued from p. 14)

does that Conair is paying would have been \$7.6 million but for the carrying forward of approximately \$4 million in losses at previous years. This would have reduced the net to about \$5.7 million—far my from the \$10,341,694 net profit of 1958. But the 1959 net was exempt from federal income taxes because of the same loss carry-forward provisions of the tax laws.

As a fact with Douglas, Conair's inventories in 1951 were then doubled over the 1953 figure, from \$35,025,621 to \$45,786,776, upon reducing the consumption of production. But the report is not nearly as informative about the 1951 work of the company as it is about the effect of high taxes.

The bulk of Conair's business is transmitted on a cost-plus basis for jobs, which O'Brien says leaves the company—after taxes—with less than one percent return on sales. He seems to prefer a sliding scale fee or "incentive" arrangement.

The company's largest aircraft producer, the B-36, started into production just prior to a CITEF contract which, normally, would have been changed by the time to a conventional contract.

• **Childs Mueller**—From the annual report, it would appear that Canby is starting more and more of its aircraft toward guided missiles. The report claims that Conair was one of the first aircraft manufacturers to conduct actively in the research and development of missiles. One outgrowth is the 1,350,000 sq. ft. plant that the company says is the "last place in the United States constructed exclusively for the production of guided missiles."

It is also a very large plant for missiles. It is as large as the Willow Run plant of Kaiser-Frazer (used during World War II) to produce B-24 bombers. Larger than several aircraft plants in the country, and more than one-third the size of Conair's large Ft. Worth factory that turns out the latest combat B-36.

Another possible indication of Conair's increasing specialization with missiles is the cover of the annual report which depicts a missile, not an airplane, in flight.

Other gleanings from the report:

- Total employment on Nov. 30 was 52,906, compared to 41,930 a year previously.
- Success to the B-60 already is under study. Conair gives no clue to what it is, stating simply "temporarily advanced as preparation for the next step" (the period, "in which, as technicians and new types of planes will be required").
- Conair 240 orders cover 145 airplanes. When these are delivered, 15



...all are equipped with the new Hartman 400-ampere high interrupting capacity cutouts

Medium wide speed range generators of large aircraft—designed to meet heavy load demands of electronic devices and other equipment formerly secured by non-electrical means—pose unusually difficult control problems.

For example, 28-volt generators can produce up to 175 volts if a short circuit applies full field at high rpm as on takeoff. So being able to interrupt these high voltages from sea level to 50,000 feet, control means must also give trouble-free operation through thousands of cycles at rated capacity... must withstand wide temperature ranges, dust, humidity, vibration, acceleration and shock.

These new Hartman Reverse Current Cutouts have an interrupting capacity greatly in excess of all requirements under all conditions. That's why today manufacturers and operators are turning to these new cutouts for use on new and existing aircraft.

So if your problem involves d-c circuits, turn it over to Hartman where it will be analyzed, engineered and produced with an efficiency that comes from nearly half a century of specialization.

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"D-C CONTROL REARQUARTERS"

MAHEFIELD, OHIO



New Hartman 400 Ampere 28 Volt Reverse Current Cutout (A-7302)



New Hartman 400-Ampere 28 Volt Cutout for aircraft use with painted surface (A-7312)

PROBLEM:

Stop Ignition Cables from Burning Out!

The standard gas collector pumping station was out of service at least one day out of every 20, causing a costly loss in gas production. Heat from the gas burning water channel and cracked the organic rubber insulation on the spines where leakage of the high voltage gases led to arcing and failure of the wires. Added to the loss in gas production was the extensive replacement cost of the ignition cables.

SOLUTION:

SILASTIC[®], the Dow Corning Silicone rubber.

Ignition cables insulated with Silastic were installed because the Silicone rubber will withstand long exposure to high voltages, arcing temperatures ranging from -100° to over 500° F.



RESULT:

No Ignition Cable Burn-outs in 2 Years.

The Silastic cables have been in use for 2 years; will probably last the life of the motor. They meet industrial maintenance needs, underpin good performance and full capacity gas production.

Silastic has high thermal conductivity and excellent dielectric properties over a wide range of frequencies. Silastic remains soft and pliable at subzero temperatures, and retains ability to stay compact with heat at temperatures in the range of 400° F. That's why design and production engineers specify Silastic for hundreds of applications where other insulating materials are subject to rapid failure.

For more facts, see page 59.

Send today the free copy of Silastic Facts '68 - containing new data on the properties, performance and applications for all Silastic products.

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silastic will be using either Corvair 2400 or 3400.



Ryan

A good example of how a rugged build-up can make a manufacturer's words under previous commitments is furnished by the report of Ryan Aero named Co. for the year ending Dec 31, 1951. Its gross assets doubled, but costs shot up so fast that operating income dropped off about 24%.

Special Seguros-Ryan was caught in an unfortunate spiral. Most of its fiscal 1951 income came from work on contracts signed before Ryan on a fixed-price basis. Inflation since then produced the kind of profit losses. 1950: \$12,824,161 (1949: \$22,577,175). Expenses: 1950: \$1,504,660 (1949: \$23,449,571). Operating income: 1950: \$1,289,505 (1949: \$27,634,416).

After taxes, which of course were lower in 1951, Ryan added \$555,147 in 1950 and \$482,900 in 1951.

President L. Claude Ryan shares the other manufacturer's view that business is high fives and not a long of fixed funds is secured in the one year. But he believes that the 1951 operating results will not be repeated and that work on contracts signed after Ryan will yield higher earnings.

Ryan's long-range outlook has put the firm of completely new model on draft in 1952, delivering the list of 151 Navajos that had been scheduled for long as their construction were required and military business increased. But the report highlights the growing interest of the company in other complete aircraft work.

Ryan now is in production of complete model motor. The motor, as of a type developed by the Calhoun Institute of Technology and will be installed in an upgraded "hot" engine of guided missiles." But as Ryan says reports the motor are being built for

lighter, it is likely that one for the Navajo in the Seguros, under high inflation, both of which are in production at Douglas. A further contract for the motor has been obtained from Lockheed, Inc. & Republic.

During fiscal 1951, Ryan delivered a test quantity of MQ-2 jet propelled pilotless target planes to USAF. The jet propulsion project is sponsored by Air Force, Navy and Army, although tests of the craft are being conducted at an Air Force base. Only about 100 of the MQ-2 is that it is about one-half the size of a jet fighter.

Other facts about Ryan disclosed in the report.

• Estimated total 1951-1952 losses to be in production, reduced quantity subject 10% in the year.

• Jet propulsion research, under way for three years at Navy contract, is scheduled to go into a new phase of advanced development.

• Backlog included \$1,742,200 at end of fiscal year, and increased to \$45,500,000 in Dec 31, 1951. On Dec 31, 1951, backlog stood at \$21,414,230. In the year of fiscal 1951, Ryan received more orders than \$2 million in cash.

• Because of the loss of airplane and other products divisions may float the same proportion this is in the present.

Only **TAC** has
perfected and produced
the **open-end
ratchet
wrench!**



Left: Open-end
Type
Right: Ratchet
Type

Free notice of orders covers full
range from 1/2" to 4". Complete
detail type wrenches are also
included. All details of our
tools are protected by Patent
numbers 2,579,656 and 2,583,607.
Other Patents pending.

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Open End Ratchet Wrench was introduced.
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Standard COIL PRODUCTS CO. INC.

INC. YEAR 1950, output \$1,645,500
metal products, \$6,463,962, 1951, as
planned, \$10,583,793, metal products
\$81,393,340



Carbon Copies of Router Patterns

Use of carbon paper is saving about 50 man-hours a week at Trusco Engineering & Mfg. Co., Inc., Dallas. New application for this duplicating technique is as simple as using a 1/2 router pattern in a single layout operation.

Alternate sheets of pattern and carbon paper are stacked on a table and the pattern traced on the top sheet of the "transparencies." Carbon paper employed is a heavy duty type and can be reused several times.

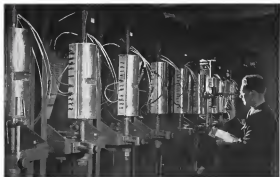
In addition to reducing layout time, Trusco reports greater accuracy as a result of producing a number of put-into conditions.

Keys for the carbon paper technique come from Trusco's J. C. Taylor as the company's sheet metal section.

This Stretchout Will Help Aviation

America's largest stretchers—a production machine for strengthening sheet metal extrusions—has been designed and selected by the Aluminex Company of America. Scheduled for installation at the company's Lafayette, Ind., extrusion works is about a year, the new stretcher will be capable of handling the large, expensive aircraft parts now on the drawing boards.

The stretcher is a supplementary machine to Aluminex's big, long, 11,100-ton extrusion press installed at Lafayette in January. The press extrudes aluminum parts beyond the strengthening capacity of current equipment. But the new Aluminex stretcher will be able to handle these parts up to a maximum cross-section of 60 sq. in.



Where Metals Give Up Their Secrets

Suppose you want a metal to conduct some particularly destructive set of service conditions.

Here's a man who can help you.

He's one of Inco's staff of engineering specialists and metallurgists. The primary responsibility is to determine how well a material qualifies for an intended use.

Often, he can find no answer to your problem among the metals and alloys he works with daily. He can tell you which of the Inco Nickel Alloys offers the most promising answer to your problem—and he can tell you just as frankly when a problem is outside the known scope of what the Inco Nickel Alloys can do.

Suppose, for example, you were caught in a predicament where you

had to find a corrosion-resisting material with greater strength and hardness than you can get even in Monel®. He can assure you an exceptionally strong alloy that has the same excellent resistance as Monel plus mechanical properties you would expect to get only in a heat-treated alloy steel. Nonmagnetic: too, down to -150° F. below zero. It's "K" Monel, one of the Inco Nickel Alloys.

Maybe high temperatures complicate your problem. In that case he would stress the service conditions and weigh out all the possible answers to your problem. Inco and "K" is just one of a number of heat-resisting Inco Nickel Alloys that include Inconel®, the Nimonic®, and the new Incoloy®—each one with different characteristics that make it best

suited for different types of high temperature problems.

Remember this man. He can tell you where nickel alloys may safely be used to replace others containing even more critical metals. He can save you a lot of trial-and-error experimentation.

If you are struggling with any problem that needs a metal for its craft use, let him find a hand. There's no charge, no obligation. If one of the Inco Nickel Alloys cannot solve your problem, he may be able to recommend another metal that will. A note to "Technical Service" at this address will receive prompt attention.

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70-30 NICKEL • 70-30 NICKEL • 70-30 NICKEL • 70-30 NICKEL
NIMONIC • INCONEL • INCONEL • INCONEL • INCONEL

Pratt & Whitney



1. Main plant at East Hartford, showing 1932 plant expansion at the night.



2. New North Haven plant, now under construction.



3. Reconstructed government-owned plant at Southington.



4. Leased plant at Meriden.

Aircraft Mobilizes!

**More hard work lies ahead, but we are winning
the battle to gain all-out production**

IN THE months that followed the outbreak of war in Korea, Pratt & Whitney Aircraft has had to meet and solve an almost unbroken series of problems in expanding its production capacity to meet urgent requirements of National Defense.

These requirements called both for tremendous expansion in the production of existing piston and jet engines, and putting into large-scale production new and advanced jet engines of our own design.

In some of these cases we have had to work out manufacturing techniques unlike any we have ever used before. More of everything has been needed. We needed more floor space, more manpower, more materials and more machine tools. All of these things have been increasingly difficult to get.

But here is what has been done.

Within the last 12 months we have made provision for almost 1,000,000 square feet of added company-owned manufacturing space. Our main plant in East Hartford will be larger by almost a third when we have expanded and occupied the present

Hamilton Standard plant next door, and we are well along on the construction of a 500,000 square-foot plant at North Haven. In addition we have reactivated a large government-owned plant of more than 500,000 square feet at Southington, and leased a sizable plant at Meriden as well as several other smaller buildings. This will bring our total manufacturing space, including test cells and office areas, to about three and a half million square feet. Our employment has steadily gone up from 18,000 to some 26,000 people.

Throughout this period of readjustment, of taking up, of new construction and of moving whole departments, we have somehow kept production rolling—and expanding. Beyond this, of course, we have made provision for additional output, both by expanding our system of subcontracting and by licensing Ford, Chrysler and Nash to build our engines.

There is still much to be done—but we are trying as hard as we know how to live up to our responsibilities to the defense effort.

Pratt & Whitney Aircraft



ONE OF THE FOUR DIVISIONS OF
UNITED AIRCRAFT CORPORATION

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— also —
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PRODUCTION BRIEFING

► American Institute of Management, New York, has awarded certificates of management excellence for 1991 to North American Aviation, Douglas Aircraft, General Aircraft, Boeing Corp. and United Aircraft Corp. The corporate functions are judged and, on order to be certified by AIM, the firm must receive 7,500 out of a possible 10,000 points.

► Geer Hydraulics, Inc., Brooklyn, N.Y., has completed an addition to its plant at 454 15th St. and is renovating the present building. This and leased space at 755 15th St. house Geer's office and plant area to over 140,000 sq ft. Geer employs more than 250 people in Brooklyn, plus sales and service personnel in several cities.

► Lescage Aircraft Corp., Graham, Tex., plans to inaugurate a \$450,000 building program adding more than 50,000 sq ft to the company's permanent building space. It is scheduled for completion by July 1. The new expansion will permit doubling Lescage's present output of 500.

► Norco Instruments, Inc., Milford, Conn., had 200 on payroll Dec. 31. New Milford plant, expected to be in production in mid-1992, will employ some 500. Another facility at Bridgeport, Conn., covering some 30,000 sq ft, will be ready for production early this year. Norco's Bridgeport has given Norco a letter of intent to acquire about \$1.5 million worth of machine tools and equipment, and the company is negotiating another facilities contract for tools for about \$1.5 million.

► North American Aviation, Inc., has started output of modified wing units, also for T-4 trainers at Hamilton Field AFB, Fremont, Ala. Terminal, Cold. Cold. Gary has leased 23 buildings from the city of Fremont at the terminal and occupies 124,363 sq ft.

► Wilco-Orion, Inc., has placed its \$10-million aluminum forging plant in operation in Erie, Pa., with the first 50,000 lb. of forgings being cranked and other forging going on. Plans for Forchick C-319s. Plant has an estimated capacity of 15 million lb. of aluminum forgings annually.

► Allison Division, General Motors Corp., has enlarged ramp space at Plant 10, also has installed about 10,000 gal. underground fuel tanks for the existing fleet plant.

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EQUIPMENT

LAS Overhaul Backlog Totals \$25 Million

- Lockheed's buses handle wide variety of jobs.
- And rebuilding a broken Connie is one of them.

By George L. Chertkov

Burbank, Calif.—Aircraft overhaul and modification companies have built up problems as a result of their split personalities.

• The overhead side has to cope with large stretches of aircraft and all their loads of components—but in small quantity—and with little or no advance warning as to the jobs coming into the shop.

• The modification branch has the reverse problem—large numbers of aircraft come through in a steady stream. To make matters tougher, an assembly line may have to be changed from a piston-engine World War II fighter line to a modern jet aircraft series almost overnight.

But despite the headlines, the truckers are far from panicking. Lookhard's Annual Survey, for instance, with centers in California and New York, now has a sizable backlog of over \$75 million. The Burbank headquarters' contributors \$72,155,000 to that figure. LAS International in Bedford has a backlog of \$3.5 million.

► **Running the Gamut**—Lockheed handles a variety, from Paper Cubes to B-56 as its main focus.

* At *Baybrook*, where 54% of the work was modification, 46% overhead was maintenance (small portion was line maintenance), and 2% task setting; the stringer accomplished over 3 rail box work hours on 547 strands of 11 different types.

• In New York, Lockheed Aircraft Service-International, whose home office is in large hangars at New York International Airport, is strong on overhead and therefore sturdy. Its staff worked 991,000 hours on 947 aircraft of 23 different types. Approximately 80% of the labor was overhead and materials since Airbus operations pushed LSI's low maintenance percentage well over Burbank's. 15% covered modification and conversion, and 5% tool-

Perhaps, even he will be made out
as a sort of martyr from Amer-



© 2004 Blackwell Publishing Ltd, *Journal of Internal Medicine* 255: 105–112



RESEARCH station was set up in gross wooded Corvina or spate were at Mlowid

the craft moving through its shops are large quantities of F 50s requiring conversion in their modified noses to become RF 50s. Other F 50s and F 33s roll through inspectors, modification, paint and test and receive their orders.

F2V Neptunes can be seen on the ramp having their clock rates modified to latest Navy standards. In some cases, huge metal dies replace wheels and are fused into nacelle and nose wheel well.

S&B's other Lockheed Aircraft Corp. products at LAS are the new Constellation for intermediate service and inspection air support (original and modifications) and Model 12s and 13s.

Other aircraft using LAS this past year included C-97s, DC-6s, DC-4s, DC-3s, A-1Es, F-51s and Grumman Walruses. LAS also demothibified B-1s at Foster Dry.

At the LAS Milford base, Counts (including non-Counts from MAT) stay in for installing from a quick turn-around inspection to a major work station job. But when Douglas DC-4s and DC-6s are frequent visitors, Air Lines consistently using LAS's big old facilities include Spokane and Western, Laker Airlines, Lind

LASER also performs miscellaneous work on a variety of aircraft including Bell helicopters, B-28s, C-97s, FB-1s, F-84s, B-26s, C-119s and B-29s. Navies

• For You & Fly You—An LASER effort

told *Aviation Week*: "We get all the tough jobs. When an outfit gets into trouble, they come to us . . . We fix 'em and fly 'em." He was not complaining, just pointing up some of the leadership of his type of operators. He concentrated more on other typical problems: Difficulty of handling a large variety of aircraft and engines and having adequate stocks of spare parts.

- Planning for the future was, in many instances, a total hellgazing job—no one knowing what was coming next
- Training personnel had its problems just as a group of men became aware

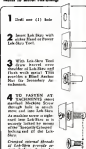
- **Variety of customers** comprises the company's workers. Customers include the military services, government agencies, airlines, executive aircraft owners and individual plane owners.
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Beyond these advantages of the only complete product line are ADEL's comprehensive field service, rigorous design developments and engineering as well as precision and efficiency in manufacturing. So standardize on ADEL—the leader in completeness of line, service and dependable performance.

ADEL also manufactures a complete line of fuel heater and servicing accessories, and clips and line supports.

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GRUMMAN'S

"Hunter-Killer Team"

The Grumman Guardian is produced in two versions, the AT-27 and the AT-28, for training and combat missions, the latter for attacking ships.



"TEAMS UP" WITH GRUMMAN TO PROVIDE CABIN TEMPERATURE CONTROL

Through close cooperation with the designers and builders of the Grumman Guardian, Barber-Colman engineers developed for this aircraft a cabin temperature control system that is outstanding in performance, light weight, and reliability under all flight conditions.

A POSITIVE, ALWAYS-RELIABLE HEATER CYCLING SYSTEM

The heart of the Barber-Colman temperature control system is a resistance bridge containing temperature-sensitive thermistors and a Microprocessor[®] positioned only for interrupting the cycling relay that powers the heater system. The bridge continuously senses cabin temperature, heater temperature, and outside temperature — then automatically adjusts the heater cycling frequency to maintain the cabin at desired comfort conditions. Thus the Grumman "Hunter-Killer Team" is second to none in mission, performance, accurate sense-work by the Barber-Colman temperature control equipment, to prevent the pilots from ideas of heat or cold that could make their work more difficult.

* Reg. U.S. Pat. Off.

LIGHT-WEIGHT CONTROLS

Engineers at Barber-Colman design and develop the AT-27 and AT-28 for all the essential areas, including Cabin Interior Climate, Cabin Interior Heating, Outside Ambient Sensing, Engine, Exhaust Discharge Heating, Door Heat Loss Prevention, and the Control Box.

ONLY 3 lbs. 7 oz.!

BARBER-COLMAN COMPANY, 1232 Rock St., Rockford, Ill.

Representatives in Los Angeles, Seattle, Chicago, Baltimore, Newark, Montreal



LOCKHEED is converting its A-26s (left) to transport for off-front and for BOMC-Cosmo interest in the B-2 seating arrangement (right).

currently in Lockheed's backlog are:

- **Crew's convenience** and **low flight deck** (Decatur Airways' Model 019 Conversion is underway at LMS. This program entails such major underpinnings as replacing the entire interior, designing 7 to 2 seating to 1 to 2 seating, one pilot's modifying the air conditioning and pressurization system (Western Gear replaced by Strain valve superchargers for greater capacity dictated by opening payload load to 74 passengers), and installing Model 749 type tanks in place of 019 tanks. Other work is closer selective fuel tank shoring and seating, installation of a completely

new policy with controlled policy policies, and latest electric cover.

A new public address system is being installed which includes five high-fidelity loudspeakers in the overhead panel and head microphones for flight deck and cockpit.

Because of the increased passenger capacity, BOMC is having two additional emergency exits installed.

LAS spokesman estimates that these of the BOMC Cosmo will be out of the shop by April.

• **Confidentiality restriction:** A BOMC Cosmo was broken during a landing accident in England some time ago. It

was severely damaged and shipped to LASI, Illinois, for "repair." LASI says this is probably the most extensive job ever done to return a Cosmo to service condition.

To do such extensive rehabilitation in the larger would have had a considerable space for too long, estimated duration was 25 weeks. So LASI officials decided to get the plane back on its landing gear by doing the work on the spot. Work is under the direct supervision of Jack Long. To protect against the risk of a Long Island crash, temporary docks were located together around the nose and main

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chiffon curtains data. Portable systems keep the interior at comfortable temperature. Other components, such as wing and empennage, are being worked on at the shop.

This refines Corsair (#1380), as being on international aspects. Some critical assemblies were damaged beyond the state of reusable system, they were replaced with aircraft from Continental #1366, purchased from Air France.

This is how the hybrid Corsair will shape up when it takes to its wings again.

• From baggage station 180 (nose) to sta 395, likewise by LASI, using part of base structure that was in good condition.

• Sta 285 to sta 360, mostly Air France #1366 with three exceptions. BOMAC's sta 260 tubular bulkhead was still in good condition, so it was reused and speed into the fuselage to avoid necessity of disturbing seating of large radio wire looms through the bulkhead. Right 260 bulkhead was Air France's cut down on condition. "near 375 electric was sealed through this side to the flight engineer's panel were suitably identified and set in a flange for ease of replacing and tapping out circuits when modification is complete. Windshield assembly and upper cockpit canopy will be from the original #1380.

• Lower fuselage section from sta 260 to sta 331 belonged to Air France.

Rest of the fuselage is BOMAC's #1380.

• Entire wing is original except for the left-hand inner section which came from Air France. The entire secondary structure section of this portion required rebuilding. Subsequently, the modification raising the gross weight to 96,000 lb. was included.

LASI means the complete new construction of the Corsair which will be delivered in a repro case manner.

• Renewed Sealing-LASI officials told Aviation Week that their company was the first in the U. S. to make permanent remounting and seal installations in military aircraft. Modification of the floor structure and installation of the floor fittings on MATS Boeing C-97's were done at LASI. A total of 25 C-97's, accommodating 60 passengers each, are at LASI.

Background of this modification goes back to 1946 when MAFF's, however, the Air Transport Command, conducted collision flights with rearward facing seats on transcontinental C-54 flights.

A poll of 1,010 high priority passengers revealed that 999 favored reversed seating, 47 objected and 16 had no comment. Of the 1,010, 835 rode backward for the first time.

Asked whether they would prefer seat forward seating, 596 said "yes".

55 "no", and 39 were noncommittal.

Problems of the seat is important. LASI quotes a positive finding: "The design does not lend itself to aircraft aircraft has shown that the position of the passenger in the aircraft is an important factor in survival. An analysis of casualties and fatalities in 70 crash landings of B-24's and aircraft showed that personnel in the rear (nose) are seven times less likely to die, than those in the middle. In fact, those in the rear are more likely to have serious injuries and three times more likely to have no injury than those forward of the landing edge of the wing.

"It was, however, therefore to place passengers in the forward as possible."

• Another installation-LASI projects, under Chief Engineer Neil Thomas, have been to place both Scientific and Sperry instruments into fuselage aircraft. Working under a subcontract from Scientific, LASI has engaged in installation of flight system instruments for the B-24, C-54 and Model 790 Constellation, according to Thomas.

KLM Royal Dutch Airlines, has at least one installation on a 747. The seat arrangement includes a completely mounted scope in the left of the flight engineer directly behind the captain's seat, where it can be seen at a glance. The switch panel assembly is mounted in the flight engineer's table, covered with a hinged, flush-mounted cover which gives the crew member a flat working surface when not manipulating the analyzer's controls.

The Sperry engine analyzer MATS 10 C-121 Constellation. This analyzer on the D-5 model, with complete on gas turbine analysis, one per cylinder (Wright Aero had to machine only portions of the cooling fan of the engine to permit instrument cylinder analysis).

The compact arrangement around the flight engineer's panel includes the scope, flush-mounted in the engineer's table. It is in control with a Plexiglas cover to provide smooth working surface. Three control switches are installed one above the other on the 260 panel—top to bottom, cycle switch, on/die switch and vibration pickup selector switch.

School Established

The Aviation Engineering Corp., Woodside, L. I., N. Y., has established a service school devoted to field servicing of electronic fuel gauges, calibration procedures, inspection methods and basic theories of operation of the newest Avion fuel piping and controlling devices. Courses are on a monthly basis, according to Aviation Engineering.

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Leakage Zero up to 4500 PSI,
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Weight 5.05 lb. dimensions: 6.16 in. stainless steel
(material optional),
Ports per ANSI 10356 for 1/4" tubes. Other sizes and
parts per ANSI 10350 available.
Temperature range — 62° to +302°F.

Perfect installations such as leakage zero—"through through,"
water-tight seal-off—leak-tight seal-off under long-term
service make the Cornelius Air Check Valve an outstanding
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Valves have high flow capacity
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several models high differential
pressure capability. Also the
model to suit, and as well as
the ball-bearing.



Ball-bearing check assembly of
several models high differential
pressure capability. Stainless
steel, ball-bearing and rubber seat
assembly is for high leakage
seal with differential pressure
as low as 0.5 PSI.

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assemblies for use in miniature motors,
synchros, or other rotating devices, has
been developed by the Nuc Corp. The
units are available with silver, gold, or
platinum rings.

The rings are mounted with a special
component having a tensile strength of
4,000 to 4,500 psi and Rockwell Hard-
ness (M Scale) of 27.0, according to the
manufacturer. Heat treatment tempera-
ture is said to be 2250° or higher. The
manufacturer also says the sliprings
will withstand 1,000 volts.

Nuc Corp., 631 South Sepulveda
Blvd., West Los Angeles 49, Calif.

Maintenance to Zep

Maintenance of all experimental and
production oxygen flight test equip-
ment used by Boeing, General, Con-
ley, Lockheed, North American and
Northrup aerospace companies has been
assigned to Zep Aero Breathing Equip-
ment Co., the Los Angeles firm in-
ventor.

Zep says it also has been awarded
a contract to overhaul all oxygen
equipment, including regulators, cylin-
ders and valves, on B-36 aircraft now
being modified at Convair, San Diego.



CLEANING UP AT AIR BASES

Here are two major cleaners used by USAF
to pick up waste and other material from
base and aircraft parking areas, where
they now help with cleanup from
the small airports according to the manufacturer.
It is one of Moulding Air Base, the de-
sign's prototype truck built by Wirtgen Air
Base. Both have been in Germany.

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Just a few of the many drives produced
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accessories are illustrated on this page.

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NEW AVIATION PRODUCTS



Sealer Smooths B-47

An aerodynamic sealer being used to boost the speed of the B-47 Stratojet bomber, was made available recently by the Minnesota Mining and Mfg. Co.

It is a paste and is applied with a putty knife to depressions around rivets, joints and other irregularities on the skin surface that might slow up the plane. The product, 3M Sealer EC-967, is described as a "tough, flexible, rubber-like substance." After being spread on, it is allowed to set, then brushed off smooth and flush with the surface, by rubbing. The company says it has excellent weathering characteristics, possesses good adhesion to metal, is resistant to all common servicing fluids, performs well over a wide temperature range (-55 to 225°F) and may be painted. Johnson and Johnson Division, Minnesota Mining & Mfg. Co., 431 Foyette Ave., Detroit 2, Mich.



Sensitive Pickups

"Type 25," a new series of temperature pickups, said to have an exceptionally stable thermal time constant (less than one sec. in water) and high voltage output, has been announced by Trans-Sonics, Inc.

Available in several ranges going up as high as 1312°F, the pickups are believed by the firm to be ideal for

temperature, measuring and remote indication of liquid and gas temperatures. They are designed for an accuracy of ±1% of full scale and carry a mounting device on the side of a square-shaped stainless steel, titanium or other metal case, as required.

The pickups can be used to follow very rapid thermal transients and their output impedance is low enough to permit use of a step-up transformer to raise voltage to at 250 volts. Control of telethermograph circuits is possible without automatic amplifiers.

The transmitters also may be used to actuate milliammeter and sensitive relay directly.

Trans-Sonics, Inc., Bedford Airport, Bedford, Mass.

Templates Faster

A giant vacuum jacking device designed to cut costs and speed turn out of metal templates by characterizing layout methods, has been developed by Miller-Trops Co.

The machine uses a single photo graphic process to reproduce the form plate design on the metal surface, avoiding the labor and time involved in drawing in lines manually. An automatic tracer permits unattended operation from one second to several minutes. The overall jacking size of the machine is 68 x 144 in. It has heavy base, heat-treated glass to keep leakage problems down.

The jacking frame can be used continuously without reworking, side and bottom reflections providing thorough, even illumination with no "hot spots," the company explains. Quick, easy repairs is provided by a bank of remote start, clean line fluorescent tubes.

Miller-Trops Co., Inc., 1085 W. Main St., Troy, Ohio.

Jet Blade Cutter

Special action for refining the metal form of stainless steel jet compressor blades have been developed by the Generalized Tool Works division of BeCo O Corp.

The cutter, carbide tipped, use a grade of carbide "that has proved best in long production runs," says the firm. They are described as rugged enough to "take heavy cuts into the tough material used for compressor blades, a particularly important feature is its chipping shavings steel. Unless substantial cuts are made when the cutting

tool is in contact with this material, glazing or rubbing may result and the metal will become work hardened, so BeCo O explains. The firm is a leader in development of large, specialized automatic grinding machines for work on jet compressors.

BeCo O Corp., 1220 Oakland Blvd., Detroit 32, Mich.

High-Temp Grease

A new grease, especially inhibiting oxidation exceeding established military and aircraft industry standards, has been developed by Yoncos.

The product is holding use in engine-driven accessories previously those exposed to engine heat, is holding wheel bearings and other applications to name a few. It provides "extended life protection" in continuous service at temperatures from -20°F all the way up to 340°F and is suitable for intermittent operation at 350°F, according to the company. The grease is said to give excellent oxidation resistance.

Tests also have shown it gives exceptional service at very high speeds and that its resistance to water makes it suitable for applications where long retention is desirable and washing out is a problem.

The Yoncos Co., 132 E. 43 St., New York.



Times Jet Igniters

An adjustable timer, operating at d.c. current and designed to control operation of a wide variety of aircraft components, has been introduced by Bell.

The device can be used to limit or sequence operating cycles of jet engine igniters, or to sequence or limit operation of infrared valves and other equipment. It permits components whose "on time" must be controlled for safety reasons or to prevent failure.

The timer, adjustable for timing cycles from a few seconds to several minutes, is driven by a conventional three-wire motor. The unit must shut instantly on interruption of current to a halting end.

Pacific Division, Bendix Aviation Corp., N. Hollywood, Calif.

ENGINEERS
NOTEBOOK

HEATING SYSTEMS

Plan Center of Industrial Design Laboratories



MARMAN

V-bands and integral welded flanges simplify duct coupling on Globemaster

An ideal arrangement for coupling iris control valves in by-pass heating duct of the Douglas C-124 Globemaster II is achieved with an integral Marmar V-Band Coupling and integral welded flanges. This V-Band Coupling and integral welded flanges is but one example of many diversified applications where standard Marmar couplings and flanges provide the right combination of strength, weight, rigidity, the right combination of strength, weight, rigidity and positive seal, plus production and maintenance advantages of the patented "Quick Coupler Bands."

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Technical Service Data Sheet

Subject: PROTECTING FRICTION SURFACES

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AMS 29 (See also U.S.A. 3-213)	Plastics, for electronic equipment
U.S.A. 11-9-2C Type II, Class A	Plastics, protective, for film and metal parts
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M-164	New economical grease specification for compressed phosphorus non-producing greases

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FINANCIAL

Airlines Plan New Stock Issues

Healthy trend toward normal private financing cited;
United, TWA, Continental, Pioneer plan flotations.

A new wave of public financing is developing for the airlines. The amount of new capital flotations promises to be the largest since 1946-1947 when a total of more than \$60 million in preferred stock and about \$16.5 million in new preferred was the all-time high for common shares were sold. That two-private financing.

United, Trans World, Continental and Pioneer Air Lines have projected stock financing plans that are likely to follow before long.

United has the largest proposed financing with a total of about \$24,000 million of convertible convertible \$100 par value preferred stock to be sold. This will be done through the offering of rights to common shareholders at the rate of one share of preferred for each 10 shares of common. At least \$22,400,000, profit share, should be raised in this manner.

United recently forced conversion of its preferred by calling the entire remaining issue for redemption. At the time of the call, some 34,980 shares of 44% preferred were outstanding and convertible at the rate of 4.259 shares of common for each share of preferred. Rather than accepting the call price of \$12.50 per share for the preferred by \$12.50, holders could obtain the equivalent of about \$125 per preferred share at present market prices through the conversion route.

Capital Structure—Exact number of new preferred shares to be authorized will be determined May 19. The conversion rate on the new shares also will be scheduled at about the same time. As of Feb. 26, 1952, United had 2,315,361 shares of common and 16,134 of the old preferred outstanding. The rest of the equity structure now consists of \$5,460,000 as 21% term bank loans, \$11,685,000 of 3½% Series A debentures due in 1967, and \$10 million of 3½% Series B debentures also due in 1967.

Previously of the new financing, which is to be underwritten by Hentzen, Ripley & Co., will be applied toward payment in 1952 \$5 million of new flight and related equipment costing approximately \$47,158,000. Included is needed \$16,770,000 for 14 DC-6Bs and 40 Convair 340s, another \$2,017,000 for ex-

cess and other flight equipment, and about \$2,771,000 for additional ground facilities.

To supplement its financial requirements, United also has a \$16 million standby bank credit agreement, good until July 1, 1953. Depreciation through and second mortgage power are expected to generate a substantial source of new funds for new capital development.

►TWA Plans—Trans World Airlines previously announced its intention to seek \$5 million through the sale of additional stock to its shareholders. Under supplemental agreements with the Securities and Exchange Commission of the U.S., holder of the airline's debentures, the company had agreed to raise \$5 million in additional equity in 1951 and so equal amount in 1952. The 1951 requirement is planned for 1951 through the proposed offering.

The offering price for the new stock has been set at \$21.25 a share and is being made available for purchase to present shareholders at the rate of one share for each ten shares held. A total of 242,985 shares are to be sold under this plan.

The Hughes Tool Co., owning about 73% of outstanding common stock, is expected to take down the entire issue of new shares offered. This will simplify readjustment of the TWA issue.

►Continental-Continental Air Lines has placed its registration an issue of \$6,954 shares of new common stock. Less than \$720,000 may be realized from this financing at current market prices. In addition, the carrier has arranged a \$4,000,000 bank credit to be secured by a charged mortgage on all assets and all shares of equipment. The interest rate will be stepped up to 4½% on the loan required in 3½% on the previous loan. As of Jan. 31, 1952, bank loans totaled \$1,384,000.

Continental's equipment expansion program will entail capital expenditures of about \$7,500,000. This will include the purchase of two DC-6Bs and seven Convair 340s. Here, too, depreciation charges and reserve power are expected to provide the balance of funds needed to pay for this expansion.

►Pioneer—Pioneer Air Lines' proposed financing has been held in abeyance due to factors beyond its control. The

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For detailed resume to: Thomas T. Marquardt, Director of Personnel, MARQUARDT AIRCRAFT COMPANY, Inc., 4400 Airport Blvd., Los Angeles 45, Calif.

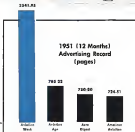
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company had placed in operation a new stock issue of 128,000 shares which was expected to raise between \$1,750,000 to \$1,350,000. In addition, a five-year loan from \$2,600,000 had been arranged. As these proceeds were to be applied in purchasing more T.O. (the public financing could not take place in view of the Martin loan) and purchase which completed the delivery of the equipment involved. It appears that this problem has now been solved and the Pioneer financing can go forward as soon as all details are settled.

Other reasons are likely to attempt public financing soon.

It is only necessary to note the huge capital expenditures planned for new aircraft and supporting facilities in addition to existing financial resources of individual entities to realize the need for new funds.

The present demands of the air transport industry for new and larger amounts of capital are nothing more than natural manifestations of the growing expansion of the group. Some of the recently indicated capital flows are designed to expand or replace existing debt. All of these new funds are being poured into equipment and physical facilities to meet anticipated demands for increasing air travel.

• **Rising Costs.** Present day expenses, however, represent far more capital than the same number of years ago in the past. The simple transition from a DC-6B to the DC-7 highlights this increasing cost. The former had a price tag of around \$1 million, while the latter costs an expenditure of about \$1.6 million per unit. One of these days a turbo-prop jet transport will be available and these will run into an estimated capital outlay of more than \$4 million per aircraft.

It is a healthy indication that all of the new projected airline capital flows are being handled through normal private financing means without recourse to government channels, such as the Reconstruction Finance Corporation.

That the financing is being accomplished with investment capital of this nature is tribute to the basic earning power generated by the airlines. As long as the group's earning power is sustained by actual earnings from the necessary capital funds will be forthcoming to finance needed expansion. It is for this reason that it remains extremely important that the airlines develop a rate of return on the investment sufficient to attract the required funds in competition with other industries which have capital requirements of their own—Selling Aircraft.

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AMBASSADOR poses in front of new B-747 London hangar where planes will be housed.

Ten Ambassadors Due in April

(McGraw-Hill World News)

London—British Overseas Airways has been promised delivery of its first ten Ambassador Ambassador transport planes in April. Another ten will be delivered by de Havilland Aircraft next fall.

The much delayed Ambassador was supposed to have gone into service with BOA last year. BOA's chief executive, Peter Macleod, actually said that at least half of BOA's £1.35-billion (\$3.5 million) deficit in 1951 was due to delays in the delivery of the Ambassador. Latest trouble has been overhauling at the village.

The 49 other Ambassadors will be fed into BOA's London-Paris route. The planes will come put in time to help cut on BOA's expanded summer services.

BOA's fleet of 49 Vikings are being retained in anticipation of retreat from the London-Paris run next fall. At short notice the aging Vikings will be capable of being used up to get from any one of five dates.

India Planning Transport Purchases

(McGraw-Hill World News)

Bombay—A heavily contested series of discussions between the Government of India and the British two-tycoon-owned Vickers-Vencom is in the cards for May and June—with the latter representing potential orders for a minimum of 15 planes.

India's eight private airlines as a carrier have recommended that the government support a national carrier to overcome the trials and make the decision.

It is likely that the winner will be asked to set up a central spare parts

- 24 passenger hours (more with reducing seats, but seats and a lot).
- 27 seat not used and low volume.
- 24 passenger, could mean and low volume.
- 18 seat and more seats with high requirements provided.

A 24-hour service with 12 cheap fare seats in a devoted cabin and 15 other seats in the other cabin. BOA still expects to be carrying the bulk of its traffic in Vikings for some years to come.

The recent announcement of the British Transport, leaving the allowance of Britain's budget orders to £15,000 in honor of our own BOA's agreement this year, but BOA chairman Lord Douglas, doesn't think this will be the way that he hopes to make up some by having more foreign carriers and by using services, or by selling new aircraft. Glaxo's, Mr. Douglas, where the travel allowance does not apply. Also additional cash flow services on BOA's commercial route will be announced soon. So far, BOA and Air France have concluded an agreement

and maintenance agreement in India, but an oral deal has been agreed to at present consideration of the order. "An again difficulties come to light in the opinion of the aircraft division," he twice contact and delivery. "When we also be asked to bear the cost of modification due to design defects, within 12 months of delivery." The Vickers's design engine relied on believed to hold some lines among operators who are providing a greater safety margin than the 340 twin engine design.

Meanwhile, a Douglas Aircraft Co. representative reports that Indian Air Force officials are attracted to the Super DC-12 and may, their government to have IAF DC-12 converted at the Bangalore Aircraft Factory.

Pilot Pay Raises Of 11-14% Approved

Wage stabilization officials have approved pilot pay raises of 11 to 14% granted in recent contracts by eight major airlines—American, United, TWA, Eastern, Capital, Braniff, Cals and Continental.

Send the Railroad and Airline Wage Board "Use of the Jan. 15, 1950, base period for reviewing changes on the stabilization program was clearly acceptable." RABW points out that pilot pay structure hadn't changed since 1947-1948 and the Board also saw there were "substantial changes in flight equipment and composition of the labor force during the past two or three years." Pilot labor contracts had expired in 1949.

RABW also bases its conclusions on the fact that the old pay formula for copiers is obsolete. It cites the President's Emergency Board findings and recommendations as the American pilot dispute here. The Emergency Board said that copiers be placed on a pay plan which "will parallel that of the first pilots at their respective levels." The Emergency Board recommended that copiers should get flight pay at 40 to 50% of captain's pay. The contract settled therefore set copiers' flight pay at 40 to 50% of captain's pay.

RABW approves the fringe benefits as well as pay raises which were to be pilots in this recent round of new contracts.

The Board sets the pay levels of 11 to 14% as permissible under the so-called "base period alternative" provisions of General Wage Regulation 6, and the cost-of-living provision of General Wage Regulation 8.

SHORTLINES

• An Coach Transport Asia, is holding a second round of negotiations meeting of new scheduled dates Mar. 31-Apr. 1 in Washington.

• An Coordinating Committee has decided to keep most of the low frequency suspension order and at least 10% of the low frequency, and probably much longer. Within requirements are cited in the main—especially possibility of national infrastructure.

• Blandford-Continental Airlines officials have been inspecting low rates on MCA's routes pending negotiation of the new contract in pending merger. Blandford President Thomas E. Blandford has issued MCA with a statement of fact company, including MCA chairman

Thomas Ryan and President J. W. MCCA.

• Caledonian Central Airlines traffic the last two months has been more than double a year ago—up 125% to 27,773 passengers carried Jan. 1-Feb. 28. The 1954 passengers carried in 24 days of Feb. more than tripled traffic of Feb., 1951.

• Northeast and Capital Airlines plan to submit to CAB their final definitive wage contract this month. They already have started playing each other's game in air and other ways. Otherwise look for CAB approval to double the wage before the end of this year.

• Central Airlines into CAB for an emergency order to secure a new route between Dallas and Oklahoma City, before final CAB disposition of the route up for election in its certificate renewal process being held by the Board in January. Defense Dept. wants Central service on the route, Central says.

• Civil Aeronautics Board has merged the Bureau of Aeronautics and Civil Aviation into a single Bureau and Civil Aeronautics division, with Bureau Chief G. Bernard Shanon as head. Two undersecretaries are Charles, Services and Administration, headed by A. M. Andrews, and Communications section, under H. R. Swaleson. Former Civil Air Chief S. B. Smith will do special assignments for Bureau Chief Gordon Bore.

• Commerce Dept. Secretary Charles Sawyer has been given a list of six and an advisory representative to form a council to "advise Commerce on matters pertaining outside the regulatory field." First meeting is slated for April 15. Sawyer emphasizes that Commerce has no responsibility for regulatory agencies in the domestic transportation field. "Spokesmen for air, rail, highway, ocean and waterway carriers, shipowners, pipeline and freight forwarders appeared the council plan."

• Council for C-46 Engineering will be based in an agreement with CAB for the regulatory authority. C-46 goes into the Civil Aeronautics Board Mar. 15. Both parties have filed briefs. CAB's brief took strong exception to the first set of fact made by CAB Executive S. T. Smith, who found CAA engineering and flight test reports on the C-46 inaccurate and incomplete.

• Eastern Air Lines is now slated to get 16 compound engine. Super Constellation now showing, this fall, instead of the summer of 1953 as previously scheduled. EAL should receive the last of its 24 Super Constellation this month.

• Northwest Airlines plans to cut more than 500 hours from Washington-Tokyo flying time with start of September reorganization of routes. DC-4 service Seattle-Tokyo and the Pan Am over the coast route route via Alaska Apr. 27. Flights from N. E. in Washington to Grant is about 185 hours.

• United Air Lines President W. A. Patterson states in UAL news that "our coach service between Los Angeles and San Francisco operates at a loss. The service route of San Francisco and the transcontinental service are showing a modest profit. Reason for this profit is that the DC-4 airplanes are practically written off our books and there is not

much depreciation from that side because of the slower speed on the DC-4 and its lack of passenger."

• Pan American World Airways pilots have at last agreed to arbitration on their 2-year-old seniority dispute (old-time PAA pilots vs. former American Overseas Airlines pilots merged by PAA over years ago). Arbitration to David L. Cole, chairman of the recent AAL Presidential Emergency Board.

• Wisconsin Central Airlines has bought their new 25 passenger DC-3s, making total fleet 30 DC-3s. Plans come from TWA and Eastern, who are replacing them with Martin 4-4s.



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LETTERS

Praise

The editorial, "Magnificent" about
Mr. Patterson, has been read by many of
us, friends who are not aviation people and
at the present time the minister of our
church is asking for its copy.

Most people to "Cockpit Viewpoint" I
have been for 20 years on light aircraft up
to 400 hp and I have yet to experience
shame from an airline pilot. Not once people
in private and commercial flying try to
instruct me on the airline pilot but to
ask me. This I do not believe. It would be
interesting if Capt. Rabson were here
today on this point of view. I think if any
being asked it is due to the close of events
which might be the private pilot and it is,
of course, the one equipped with it will
find themselves in an instrument situation
of engine engine engine. However, all the
engine and to encourage his sense on PFI,
RIS and GCA.

W. B. STEVENS, Aviation Geographic
State Teachers College
Bloomington, TN

I want you to know how much we ap-
preciate George Christian's article Feb. 4. It
was not only good from our standpoint—
it was accurate. Thanks so much for a very
fine article.

LEE KENNEDY
Director Public Relations
The Flight Sign-Lite Inc.
Lockport, Ill. 60451
Berkshire, Calif.

I would appreciate your permission to re-
print the article "Self-Defense 1,230 Miles
upped," which appeared in *Airnews*
March Feb. 15.

MARY FRANKLIN, Editor
The Freeman's Digest
Miami, Conn.

Just three more wild claims that A. W.
Hoyes' "MIG-15s Dismantle A Bomb
Hopper" is printed in the press nationally?
It is not but the knock of bringing forth the
true situation.

Keep up the good work.

J. E. MOORE
Rt. 2, Box 1001
De Soto, Miss.

Now that, on the proposed engine test
aircrafts will show that I want to say
about the picture from the landscape which
you were given a view which contained so
much fact and detail. It was definitely a
good job.

THOMAS J. BROWN, Jr.
Service Manager
Curtis Wright Corp.
Wright Aeronautical Div.
Ward Ridge, N. J.

The article, "Tubes Composed 'Tern
Pilot' Series" in the Feb. 15 *Airnews*
were a real find. George Christian did
an outstanding job of reporting on the
technical, historical subjects, and his
interpretation of the facts and relevance

from his obtained during his visit to Ward
Ridge is not only accurate, but clearly and
concisely written.

K. C. MERRICK,
Public Relations Manager
Wright Aeronautical
Div. of Curtiss-Wright Corp.
Ward Ridge, N. J.

History Repeats

Some years ago it was in a museum in
New Orleans and was a portion on the wall
and presented a photograph of a ship. I
do not know if it was a ship. I saw the
captain's quarters looking at New
York Airport.

I have been made the impression that



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WITNESS MECHANICAL CIVILIZATION
DREADFUL CASUALTY!

LOCOMOTIVE RAIL ROAD!
SUBURB OF NEW YORK!!

OUTRAGE!

the distance from Elizabeth to Newark has
been changed and then the planes are going
away, and the convenience of these rapid
aircrafts within 20 miles occurring within
two or three months from incident cannot
be denied but we are now preparing for
the future day stopping the railroad from
going through the city where the railroad
was a disaster, which I believe is a
disaster.

Rebecca M. Moore, President
Low Inc.
Coral Gables 2, Fla.

Praise for a Pilot

For a magnificent view of some of the
most interesting history in aviation,
coupled with an eye sight work, I recom-
mend AAL Flight 913 and the San Francisco
expedition of Capt. J. J. Bente in the con-
tainer. Within a couple of hours he will
show you more notable places and give you
more history about what you are than you
could receive in a week of ground travel.

From the time he began sailing his boat
the Delta Mountain Canal at Golden Gate
Coastal Valley Project since a voyage from
up hill and he was off from New York. Never
he looks up a speed for description of what

the passengers are. Along with it he gives
us a history of the canal, the history of the
canal and the history of the canal. It is a
very nice book about the canal that gives
you a history of the canal that gives you a
history of the canal. It is a very nice book
about the canal that gives you a history of
the canal. It is a very nice book about the
canal that gives you a history of the canal.

A few months later he points out the
highest and lowest places in the 40 states—
all 40 states in 1947. It is a very nice book
about the canal that gives you a history of
the canal. It is a very nice book about the
canal that gives you a history of the canal.

When he goes to New York you can see
the history of the canal that gives you a
history of the canal. It is a very nice book
about the canal that gives you a history of
the canal. It is a very nice book about the
canal that gives you a history of the canal.

The final page is a picture of an airplane
approach under a cloudy sky. It is a very
nice picture of an airplane approach under
a cloudy sky. It is a very nice picture of
an airplane approach under a cloudy sky.

I'm not just a book of people, I'm
a book of people. I'm not just a book of
people, I'm a book of people. I'm not just
a book of people, I'm a book of people. I'm
not just a book of people, I'm a book of
people. I'm not just a book of people, I'm
a book of people. I'm not just a book of
people, I'm a book of people. I'm not just
a book of people, I'm a book of people.

"Scare Headlines"

My heartfelt congratulations to you
regarding the lengthiness in placing this
editorial concerning airline headlines in
Editorial and Publisher. The industry in
general, subjected to you the struggle
forward approach you have taken to the
current problem.

T. H. Davis, President
Professional Aviation, Inc.
San Francisco Airport
Winton Sales 1, N. C.

Censorship

You do not feel of censorship in
connection with the airline industry, and I'm
looking forward to the results.

I plan to make members of the work
in the airline industry.

Rebecca M. Moore, President
Low Inc.
Coral Gables 2, Fla.

Put Your Scrap Back to Work

SPECIFICATIONS

MIL-1410 (USARF)
(Formerly AAF 10500)
AAF 10500A
MIL-1410 (USARF)
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Type: standard (FIRE/REPAIR)
Type: standard (FIRE/REPAIR)

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SIATUPE E. C. King, Inc., 115 Hudson Street, Boston 7-540
WICHITA Associated Aircraft Sales, Inc., 320 E. Douglas Ave., 4-6179

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Engineers must have: Aeronautical Engineering degree, Aircraft and Engine Mechanics license, CAA Flight Engineer rating with 400 hours flight experience, experience in flight or GVT, 3 years' experience with scheduled status of shop, supervisory or shop-employee level.

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Aeronautical Engineering Lab
Research Research Center - Research Wing 100

AN AERIAL AVIATION SALES REPRESENTATIVE is needed to promote and sell aircraft. Must be a graduate of a college or university with a degree in aeronautical engineering or a related field. Must have a minimum of two years' experience in the field of aircraft sales. Salary and benefits commensurate with experience. Write to: Mr. J. K. Stewart.

RESEARCH ENGINEER in the field of aircraft design and development. Must have a degree in aeronautical engineering or a related field. Must have a minimum of two years' experience in the field of aircraft design and development. Write to: Mr. J. K. Stewart.

POSITION VACANT

RESEARCH ENGINEER in the field of aircraft design and development. Must have a degree in aeronautical engineering or a related field. Must have a minimum of two years' experience in the field of aircraft design and development. Write to: Mr. J. K. Stewart.

POSITIONS WANTED

A RESEARCH ENGINEER in the field of aircraft design and development. Must have a degree in aeronautical engineering or a related field. Must have a minimum of two years' experience in the field of aircraft design and development. Write to: Mr. J. K. Stewart.

A RESEARCH ENGINEER in the field of aircraft design and development. Must have a degree in aeronautical engineering or a related field. Must have a minimum of two years' experience in the field of aircraft design and development. Write to: Mr. J. K. Stewart.

FOR SALE

For sale: A complete set of aircraft design and development data. Must have a degree in aeronautical engineering or a related field. Must have a minimum of two years' experience in the field of aircraft design and development. Write to: Mr. J. K. Stewart.

For sale: A complete set of aircraft design and development data. Must have a degree in aeronautical engineering or a related field. Must have a minimum of two years' experience in the field of aircraft design and development. Write to: Mr. J. K. Stewart.

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Have and expanding division of an established plant with 20 years of successful experience in the instrument field. Work involved deals with the instrument and development of highly sensitive equipment of the most advanced type.

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ENGINEERS



Good Year Aircraft Corporation, one of the oldest aircraft development organizations in the field, now offers unusual opportunities to engineers, both experienced and recent graduates, in all branches of aircraft design and development.

In addition to manufacturing airplanes and missiles, Good Year Aircraft builds a number of small aircraft components as well as guided missiles and other material for the defense program. The diversification of products beyond purely defense needs, at Good Year Aircraft, has resulted in an extremely stable and progressive organization throughout past war years.

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Personnel are needed in the following classifications:

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STRESS AND WEIGHT ANALYSTS

Previous experience and formal education desirable. However, applicants without formal education but with equivalent practical experience in other engineering fields will be given consideration.

You are invited to investigate these opportunities by submitting a resume of your qualifications and experience or by simply sending for an application letter of which will be given prompt and serious consideration.

Address all correspondence to
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GOOD YEAR
AIRCRAFT CORPORATION

ALBANY 14, OREGON

(Continued from p. 18)
a pilot. The pilot dips up another reporter, sends to the desk, and the proceeding is over.

On one plane record in Newark it proceeded, in the same fashion a link Newark as of another airport.

But the records are not the only newspaper in the market.

PURCHASED LIQUOR

On Jan. 31, a CAA inspector boarded a dual DC-4 at Belmont, Brazil. At Trinidad, he bought two cans of liquor and placed them on the plane for sale to the United States.

At Trinidad, this inspector checked the condition of the plane and found that it had a type which dropped in flight, due to a flaw in the hydraulic system.

The plane should have been grounded, according to CAA regulations, but evidently the inspector was afraid to do so, for the pilot would turn the liquor over to Customs men at Puerto Rico for him.

Now it has been brought in a formal complaint to CAA, but the plane got through with its faulty steps and got its run through the air.

The CAA spokesman in Washington stated that the Trinidad run was under investigation right now, but that the Puerto Rico and St. Thomas activities "were all in the office."

SAFETY AND POLITICS

It represents politics at work in the local area, in the field of safety enhancement, which compares with the legislative politics described yesterday and it was mostly behind the scenes were that the public never knows this.

Finally it is due to the decentralization of the vast CAA, leaving the remote and small manner of its operation, by its leadership of the regional administration. There are light cases and there are soft cases.

This is not only a fact, it is the case of the perfect air transport safety in the future.

PAID IN WEIGHT

One more point and we are ready to turn to the next installment. That point is the obvious trend of the liquor smuggling market in terms of its freight weight.

A case of Puerto Rican rum weighs in follows, when packed:

A case of 12 bottles of 80-100 pounds

A case of 12 bottles of 40-60 pounds

The Forgotten Oath

The troubling story above is an incredible report. But *America's Worst* is finding other incredible conditions in CAA's Office of Aviation Safety has. These too will be reported.

It can be noted today that CAA's chief information officer, among with reporters the night of Feb. 12, was laughing at the Journal-American story, instead of pursuing an investigation and clearing. His attitude was: "What others don't try to bring some house into the country's attention?" The scene was the Casa Rosada Hotel, where press sites—attending a major seminar of *America's Worst*—invited to participate in a safety meeting of airline and N.Y. Port Authority executives.

Can Aviation Safety Agent Harlow, GMS Director Ernest Henrich, his deputy, Wilbur Davis, CAA's press chief, and certain others have forgotten the oath they took when they entered federal service?

Let's refresh a few memories and report it here: "I (name) do solemnly swear that I will support and defend the Constitution of the United States against all enemies foreign and domestic; that I will bear true faith and allegiance to the same; that I take this obligation freely without mental reservation or purpose of evasion; that I will will and truthfully discharge the duties of the office on which I am about to enter to help our God."

Crashes & Perspective

Massachusetts Mutual Life Insurance Co. is circulating a thought-provoking editorial on commercial air line safety. It puts sensational newspaper headlines in refreshing perspective.

Also pointing out both in air travel, Continental Casualty Co. has doubled its insurance air trip accident insurance offered to scheduled airline passengers. A passenger can now buy \$20,000 insurance for \$1.90 when he could buy only up to \$25,000 at \$1.25 before Associated American Underwriters is expected to follow suit.

In announcing the increased coverage available to passengers, Continental placed an ad in the general press titled "Open letters to the scheduled airlines of America." It stated that the recent accident crash at Elizabeth, N. J., on non-commercial flight that the general public might not notice that: "We know of only one way to prove that we have nothing but faith and confidence in our (the airline's) ability to earn those passengers' safety. The letter stated: "Inadequate effective immediately, we are doubling the amount of our air trip insurance."

"If you travel in air today, you probably know that cabin premiums for ordinary passenger flights have been eliminated," the Massachusetts Mutual letter says.

"Extra protection for pilots and crew members have been reduced to almost nothing of what they were."

"Such insurance rates furnish a better index of contemporary progress in aviation than headlines reporting occasional airplane disasters."

Insurance companies know their mortality statistics. You can't brake them or make them into calling acts unless there is a good reason for doing it. You can't panic them with sensationalism.

All airline accidents are bad. Aviation must keep fighting to improve its record. But left out over part of the story of the record. Massachusetts Mutual and Continental Casualty are helping us show the record in it.

TV & Sensationalism

We have had several judgment reports from readers on an information television show on NBC the night of Feb. 1, during the Elizabeth hysteria.

A "news" program sponsored by a right firm and conducted by John Cameron Squire put on a recording with stock pictures of a number of major airports throughout the country, including Cleveland, Willow Run (Detroit), Kansas City and Los Angeles.

According to Squire, not only Elizabeth was up to some about nearby airports. Attention was also drawn to Detroit to near Willow Run and in Cleveland. "He pointed a big sign of excitement," our Detroit reader tells us. "So far in Willow Run—25 miles out in the country—is concerned, 'breaststroke' jet doesn't exist here." We saw the same from Kansas City and Cleveland.

We hope TV doesn't get both to the same kind of sensationalism that a noisy minority of the day press has adopted. Let's keep our eye on Mr. Squire and others like him.

—Robert H. Wood



klystrons

AT WORK IN THE LABORATORY

Sperry Klystron tubes are doing heavy duty in the labs where a potential source of continuous microwave energy is needed for general use in measuring work. A complete line of 2k tubes is available for bench operation and from 2600 to 10,000 mc.

Starting from its pioneer role in the development of the Klystron in 1919, Sperry has had many years' experience in the manufacture of these tubes. Over the 2k series for laboratory use, other Sperry Klystrons include: a variety of tubes for microwave relay, radar (both pulsed and cw), radar beacon, astronomical navigation (DME and RLR), and radio astronomy stations. Other Sperry Klystrons are used as local oscillators in radar and microwave communication receivers. Klystron multiplier tubes are used as frequency standard and for other applications where crystal control at microwave frequencies is desired.

Sperry's pioneering in microwave measuring techniques has resulted in a complete line of "Microlab" instruments which includes every type of device essential to precision measurement, in the microwave range.

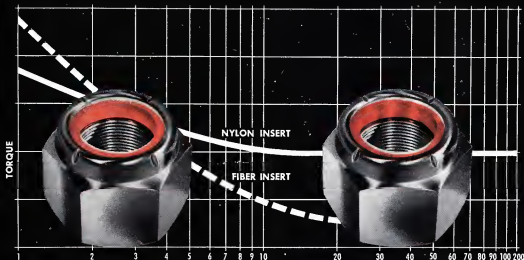
Our Special Electronics Department will be happy to supply you with a complete details on Klystrons and "Microlab" equipment.

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Elastic Stop Nuts with the fiber locking insert assure satisfactory locking torque characteristics for normal reusability requirements.

New nylon locking inserts, now available for any standard type or size of Elastic Stop Nut, will provide more than 200 re-use cycles.

How do you measure Reusability?

UP TO FIFTEEN TIMES?

For assemblies that must be locked in place, Elastic Stop Nuts with fiber locking inserts guarantee a permanently secure grip—plus ample reusability to cover most normal maintenance requirements.

For assemblies that must be disassembled and reassembled five, eight, ten, or more times during normal use, fiber insert Elastic Stop Nuts make the ideal self-locking fastener.

When an Elastic Stop Nut is run on a bolt, the Red Elastic Collar hugs the bolt—actually makes a skin-tight fit against the entire contact length of the threads—and this controlled torque firmly resists vibration or shock. When the Elastic Stop Nut is removed from the bolt, the natural resiliency of the Red Elastic Collar is your guarantee of continuing torque when the nut is reapplied.

MORE THAN FIFTEEN TIMES?

Now, for assemblies that require constant adjustment or frequent disassembly for checking and maintenance, ESNA offers all standard types and sizes of Elastic Stop Nuts with the new nylon locking inserts.

Reusable up to 200 times with remarkably constant torque characteristics, these new Elastic Stop Nuts offer the one-piece construction, the shock resistance, and the moisture-seal features that many manufacturers now depend upon in the standard Elastic Stop Nuts.

One of these Elastic Stop Nuts is probably the solution to your most troublesome fastener problem. It will pay you to look into the self-locking performance of Elastic Stop Nuts. For information, write for a new, free booklet. **Elastic Stop Nut Corporation of America**, 2330 Vauxhall Road, Union, New Jersey, Dept. N5-325.

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